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Machining Locomotive Parts In the Frisco Shops

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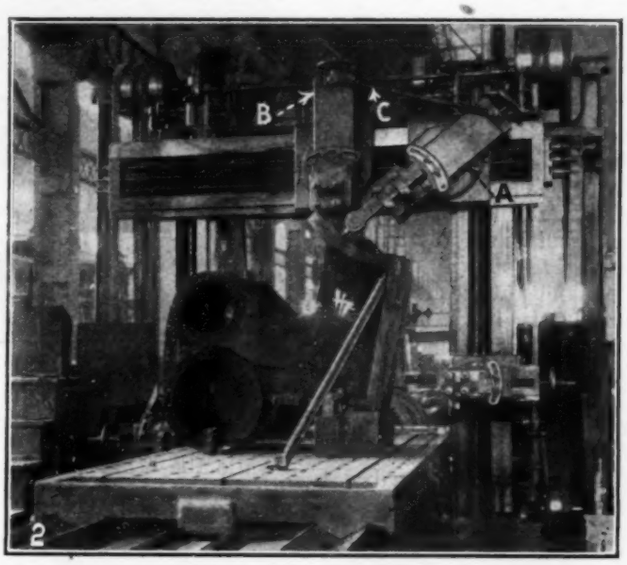
Machining engine parts in a well-equipped shop—Advantages of modern machinery—Reducing hand labor to a minimum—Shop methods

WHILE railroad shops are, as a rule, not as efficient as they should be, there are a few which, in the matter of methods and equipment, stand out as examples to all the rest. Among these few are the "west" shops of the St. Louis & San Francisco Railway, otherwise known as the Frisco Lines, at Springfield, Mo. The economy of good equipment has been recognized here, and laborious, costly methods have been discarded for those of more recent origin. A number of new machines have been added in the past year, making the equipment practically complete and placing this shop in the front rank of shops handling work of the size and class usually encountered in railroad shops.



There are some jobs in the repairing of locomotives which, while common to practically all shops, are handled in a variety of ways. Among these is the boring of cylinders. In the Frisco shops the operation is performed on a horizontal boring machine, built by the Locomotive Finished Material Co., Atchison, Kan. The cylinder is bolted to the table of the machine as shown and the tool is clamped in a head which is attached to the machine spindle. The tool is of ¾x1½-in. high speed steel, this steel being used for all tools throughout the shop. The cylinder is for 30-in. stroke and is 29 in. in diameter and the tool head is large enough to afford sufficient support for the tool. At a cutting speed of

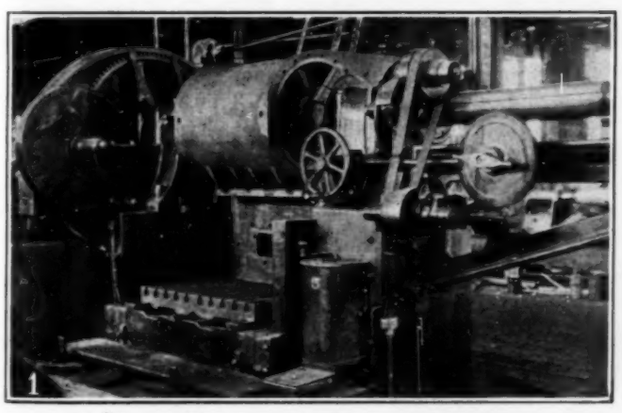


FIG. 1—TURNING AND BORING CYLINDERS. FIG. 2—PLANING RADIUS ON CYLINDERS.
FIG. 3—PLANING FRONT DECK PLATES

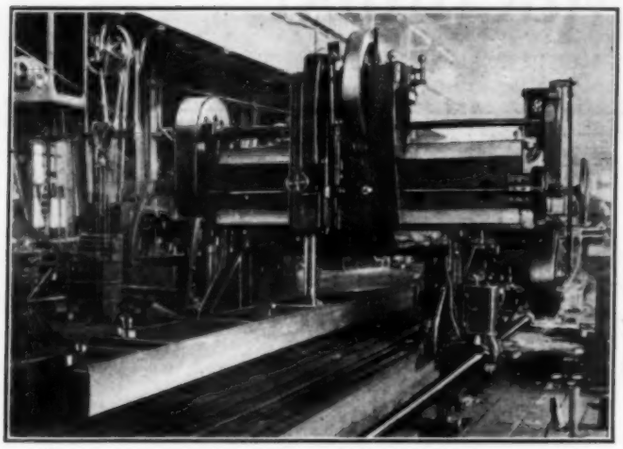


FIG. 4—SLOTTING SIDE FRAMES

40 ft. per min. and a feed of $\frac{1}{16}$ in. per revolution, a cut up to $\frac{1}{2}$ in. in depth can be taken without difficulty. Two cuts are taken through a cylinder so as to insure that it will be perfectly round and within a limit of $\frac{1}{64}$ in. of the specific size, the finish cut removing approximately $\frac{1}{32}$ in. of stock at a feed of $\frac{1}{2}$ in. per revolution. The only gage used is a caliper, and a cylinder can be finished in approximately eight hours.

Another operation that has been speeded up by the use of modern equipment is that of planing the radius on the cylinder. The operation was once done by chipping with air hammers and chisels and took one man six hours to complete the job. With the machine shown in Fig. 2, two cylinders, set in tandem, can be finished, floor to floor, in five hours. The machine is a Putnam planer with an 8x14-ft. table. The tool is a section of 1x2-in. high speed steel. The head *A*, in which the tool is held, is fed down until the point of the tool is at the proper distance from the center of the swivel to produce the correct radius, and is attached to the other head *B* by means of the bar *C*, as shown. Then the head *A* is locked in position and the head *B* is fed across the rail of the machine, swinging head *A* as it does so and producing the desired radius on the work. The stock varies from $\frac{1}{4}$ in. to $\frac{3}{8}$ in., all of which can be removed at one cut with the tool feeding $\frac{1}{16}$ in per cut. The table travels 40 ft. per min. on the cut and 60 ft. per min. on the return. A limit of $\frac{1}{32}$ in. is allowed.

Work that is too large for the planer described in the preceding paragraph, or that is too wide to pass between the uprights, is handled on the machine shown in Fig. 3. The machine is a Cincinnati open side planer with a 65-ft. bed and a 4½-ft. table, and the job shown in operation is that of planing a front deck plate. The tool used is 1x2-in., feeding across the work at a rate of $\frac{1}{16}$ in. per cut. The amount of stock on these pieces varies from $\frac{1}{8}$ in. to $\frac{1}{2}$ in., and just enough is taken off to clean up. The speed of the machine is 50 ft. per min. on the cut and 70 ft. per min. on the return. A plate can be finished on all sides in seven hours.

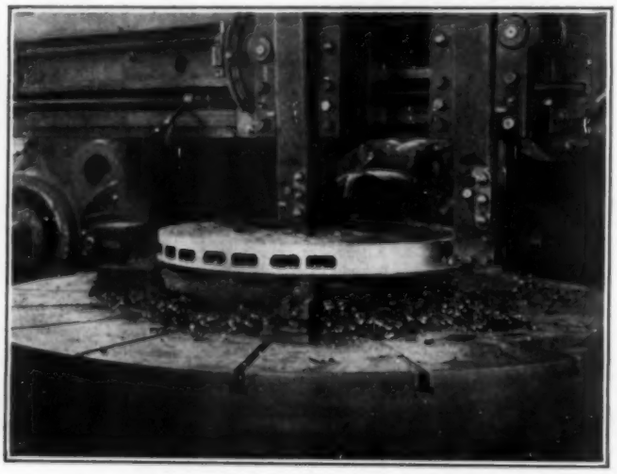


FIG. 5—TURNING MAIN DRIVING WHEEL

The operation of slotting a pair of side frames is shown in Fig. 4. The machine is a Niles-Bement-Pond frame-slotter, built especially for this job. The frames are forgings and are laid out to size before being placed on the slotter table. The tool, which is 1x2 in., travels at a speed of 40 ft. per minute and a feed of $\frac{1}{16}$ in. per cut, removing up to $\frac{3}{8}$ in. of stock. Two cuts are taken where the stock is heavy so that the cut will be straight and on the line. Two frames are machined at a time, one on top of the other as shown, forming a 10-in. thickness. Four frames are machined in 32 hours on this machine.

The operation of turning and boring a cast steel main driving wheel is shown in Fig. 5. The machine is a Cincinnati 12-ft. boring mill and is equipped with two heads, one of which is used for turning the wheel while the other is boring the hub. The wheel turns at a speed of 60 ft. per min. while the tool, which is 1½-in. square, takes a ¼-in. cut, feeding down $\frac{1}{16}$ in. per revolution. The wheel is 6 in. thick at the periphery and 9 in. thick through the hub. A limit of 0.005 in. is allowed and the only gage used is a caliper. Eight hours are required to finish a wheel.

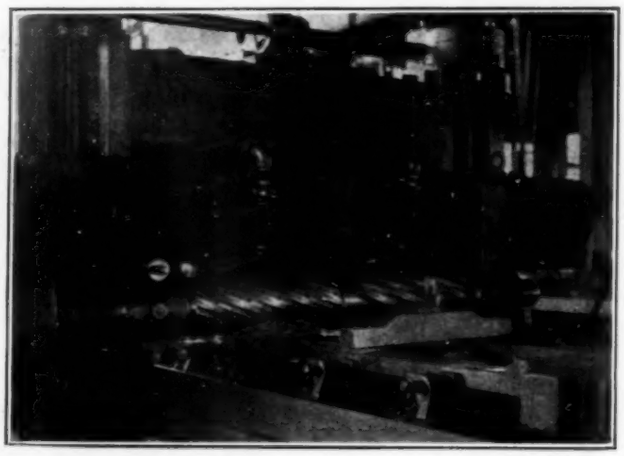


FIG. 6—THE SLAB MILLER IN OPERATION

An Ingersoll milling machine, slab-milling a pair of side rods, is shown in Fig. 6. This is in line with the most advanced machine shop practice, the machine in use being especially designed for work of this class. The pieces are held in position by the use of clamps at the middle and both ends, supplemented with set screws at the sides. After one end has been milled, the middle clamp is removed while the table is being passed under the cutters and is then replaced. The same side of both rods is milled in one operation, then the rods are turned over and the other side is finished.

Two Ingersoll inserted tooth cutters are used, each 9x24 in. The cutters turn at 22 r.p.m. or 52 ft. per min., taking a cut of from ¼ in to ½ in. while the table is feeding from 3 in. to 5½ in. per min., depending on the

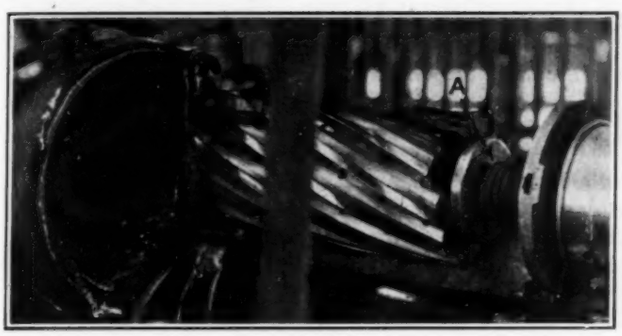


FIG. 7—GRINDING A SLAB MILLING CUTTER

hardness of the metal and the depth of the cut. The work is laid out before coming to the milling machine, so that the machine is kept producing as much of the time as possible. A copious flow of cutting compound keeps the cutters cool. Two of these rods are finished in from six to eight hours, depending on the amount of stock, hardness, etc.

The illustration, Fig. 7, shows how one of the cutters spoken of in the preceding paragraph is set up for grinding. The cutter is held on a mandrel that is swung between the centers of a Cincinnati No. 3 grinder. A 1x12-in. Norton 3,860-K wheel is used, the point of contact between the wheel and the work being washed by a continuous flow of cutting compound. The rest for the cutter blade is stationary so that as the table passes the grinding wheel, the angle of the blade where it comes in contact with the wheel is always the same. As the blade is spiral, the cam-action of the blade riding on the rest forces the cutter to revolve slowly. The blade is kept in contact with the rest by means of a rope that is wound around the end of the mandrel as shown at *A*, then passed out over an arm on the front of the machine, and down, a weight being attached to the end to provide the necessary pull. As the cutters are used in pairs, they must be of the same diameter; consequently an extra amount of care is taken in the grinding. It usually takes about eight hours to grind a cutter of the size used for this kind of work.

Figure 8 shows the milling of the outside of the side rods at the ends. The rotary movement of the Ingersoll vertical milling machine allows the proper radius to be easily secured. The cutter is 5x12 in. with inserted teeth and cuts from ½ to 1¼ in. from the forging, at 36 r.p.m. Both ends are milled by shifting the rods to both the bushing holes and the knuckle pin hole, in approximately 6 hours.

Another milling job—that of milling out the end of a side rod—is shown in Fig. 9. The operation is being done on an Ingersoll vertical milling machine, using a high speed steel cutter, 1¾ in. in diameter. An opening is first made with a drill, then the hole is finished to size on the machine. A cut can be taken that is equal to the diameter of the cutter, the cutter running at 120 r.p.m. and feeding at a rate of 1 in. per minute. Two cuts are required, the roughing cut taking three hours and the finishing cut one hour. There are no limits given, the operator working to a layout line.

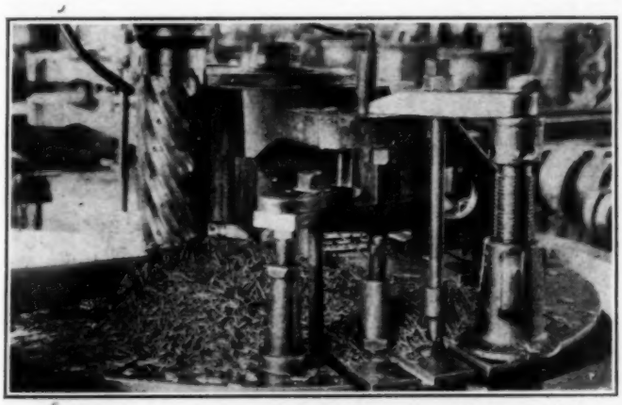


FIG. 8—PROFILING ENDS OF SIDE RODS

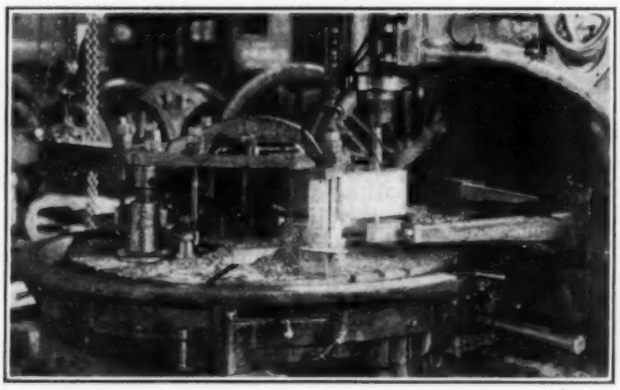


FIG. 9—MILLING OUT END OF SIDE ROD

The vertical milling machine is also used for milling out the jaws on the front or back sections of side rods. The same speed and feed as that used for the side rods is used, and two cuts are required to finish the piece.

The operation of boring and trepanning a pair of main rods is illustrated in Fig. 10. The machine is a Baker Bros. double spindle drill, working on two rods

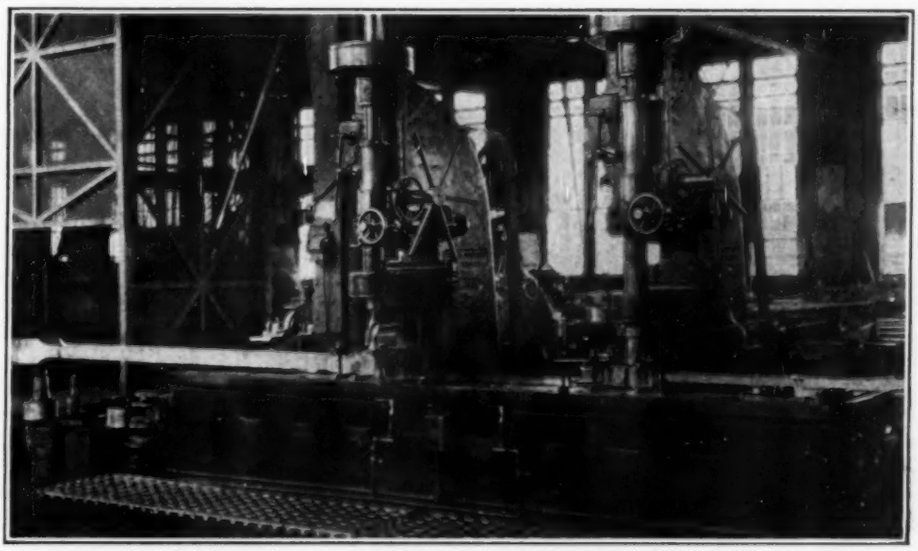


FIG. 10—BORING AND TREPANNING MAIN RODS

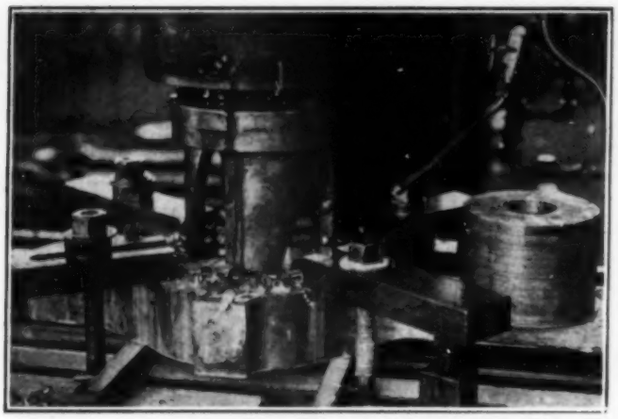


FIG. 11—TREPANNING TOOL

at the same time. As the rod ends are solid, the first operation is to drill a hole with the 2½-in. drill shown in the spindle at the left. The piece is then moved over to the other spindle and a trepanning tool is used which cuts out a block, leaving a hole of the size desired. The tool used on this particular job, shown in Fig. 11, is 8 in. in diameter. Four sizes of tools—8 in., 9 in., and 11 in.—are used for the different sizes of rods. The body of the tool is of machine steel, turned and bored so that a wall ⅝ in. thick is obtained, and sections are then cut out of the wall in four places, leaving four blades. The cutters are of ¹¹⁄₁₆-in. square high speed steel, each slotted at the rear side to fit a tongue on the blade of the tool, and each cutter is held in place by two cap screws, as shown. As each cutter has to be ground on the sides to conform to the circle that it is to cut, the width of the finished cutter is slightly more than ⅝ in. The speed of the tool is 12 r.p.m., feeding 0.012 in. per revolution. As the tool cuts through the piece, it cuts out a solid round block of steel similar to that shown on the table of the machine. The time required for the operation is 50 min., of which 35 min. is the actual cutting time.

A machine that will practically pay for itself within a reasonable length of time by producing better work at a lower cost, is a link grinder. A Newton link grinder in operation can be seen in Fig. 12. The links used on Frisco engines are usually made of cast steel, although the one shown here is a forging. The wheel, which is 1¾ in. in diameter (when new) and 4 in. long, revolves at a speed of 3,600 r.p.m. and takes a cut of approximately 0.005 in. or 0.006 in. The table travels at a speed of 40 ft. per min. Only enough stock is removed to clean up.

Everything possible is being done in this shop to eliminate hand labor. Two overhead cranes handle all the very large parts, and smaller parts are transported about the shop and lifted on and off machines with the aid of Elwell-Parker electric industrial trucks similar to the one shown in Fig. 13. The crane has a lifting capacity of 3,000 lb. and is very valuable in a shop of this class.

A number of air hoists like the one shown in the background, Fig. 13, are also installed at different machines throughout the shop, and the time they save in material handling plus the saving made on the loss of time and money due to accidents, puts them in the class of good investments.

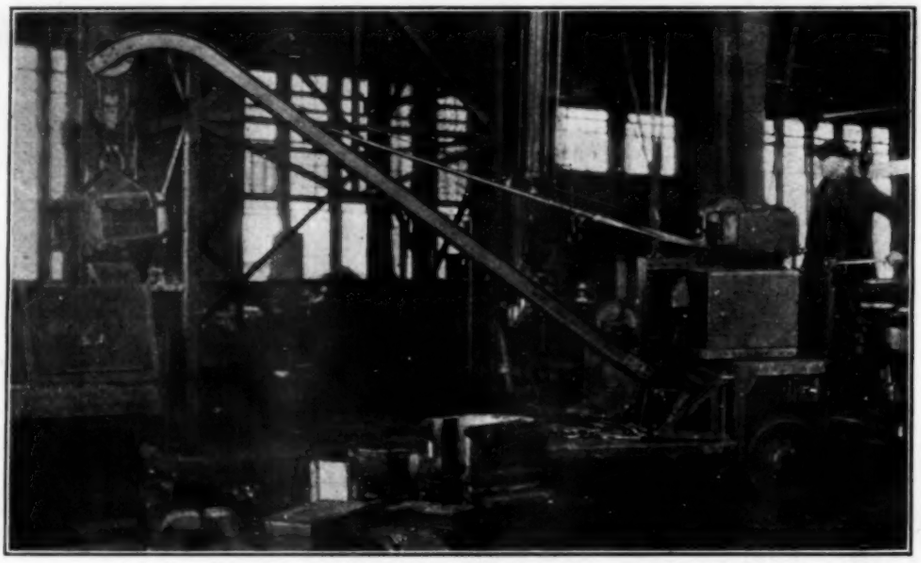


FIG. 13—SOLVING THE "COMMON LABOR" PROBLEM

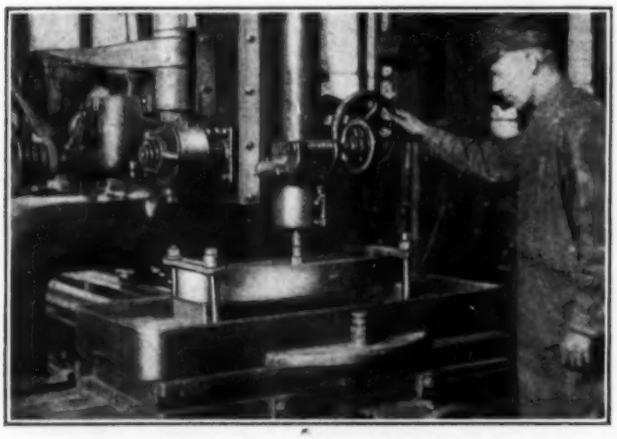


FIG. 12—THE LINK GRINDER IN OPERATION

Continuous Cleaning of Machine Parts

One of the notable changes in machine shop practice and equipment is the increasing use of washing machines for cleaning the dirt and grease from the work. While this is perhaps more frequently used after the parts are finished and just before they go to assembly, the washing machine is also finding its place between operations to an increasing extent.

In place of the old soda kettle which frequently became a nuisance and a menace and of the dangerous gasoline bath we now have the continuous steam washer, where the dirty work goes in at one end and comes out at the other—clean. And while it may perhaps be classed as a minor improvement, it shows one of the tendencies of the times in modern manufacturing methods.

What About Automobile Shops?

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AND
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Fourth and final article in which points are summed up and suggestions offered—How new machines have been developed and how they may be in future

IN THE final article of a series like this one the reader naturally expects a summing up of any points that have been made in other articles of the series. He also expects those responsible for the articles to offer in it any remedies they may have for some of the things they have been so free in criticising. It shall be our endeavor to meet with these requirements in what follows.

If we may be permitted to generalize in our criticism of automobile shop practice as exemplified in the shops we visited, we would say that far advanced as the automotive industry is in its application of high production machine tools and all sorts of labor saving, handling and conveying machinery, there is still too much waste and expenditure of physical energy. We would repeat that this should be taken as a general conclusion only. Some of the shops have gone far beyond the others in adopting the latest equipment and applying the most modern methods of production. But there are others whose production is relatively large in which there is room for improvement.

IT is estimated by a competent authority that the installation of special automatic machine tools in one of the largest automobile plants has meant that one man can now produce the same output as could four men without them. When we consider that the plant in question is now just about as full of busy operators as is physically possible, we can get some idea of what the highly developed machine tool has meant to the industry.

Everyone connected with the automobile industry, while proud of what has already been done in mass production, concedes readily that even more must be done in the immediate future. More production tools are to be developed but is the old way of doing it the best for all concerned?

Assembling conveyors, for instance, have had perhaps their most complete application in the automobile plants. It is a pleasure to anyone whether he understands shop practice or not to witness the operation of a modern automobile assembly line. When it comes to inter-machine conveyors, however, there are many places in most of the shops where they could be applied to better advantage than is now the case. There is entirely too much handling of parts and sub-assemblies before they reach the final stages. We do not recommend any particular type of inter-machine conveyor as local conditions must naturally govern the choice. What would work perfectly well in one shop might prove a dismal failure in another.

With better arrangements for getting the work from machine to machine a vast amount of physical energy now expended in lifting iron about could be conserved. As we remarked in the second article, the task of the operator in a modern production plant should be primarily to direct the functions of machinery rather than to do physical work that a machine could do very much better.

Even where the inter-machine conveyor has reached its highest development in the automobile shops, we noticed that it was so arranged in several places that the greater part of the work done by some of the men along the line consisted of lifting fairly heavy parts some inches higher than their heads. There was no apparent reason why the conveyor could not have been run at a more convenient altitude. It was evidently a case of a place where sufficient attention had not been paid to details.

A considerable saving of human effort and time as well could be obtained by a wider use of magazine feeds on various types of machines. As compared to the practice in other high production machine shops, automobile shop practice does not seem to have advanced very far in this one particular. We are glad to say that we observed in most of the shops visited, growing interest in both of the subjects just mentioned. From information that was given us as to the plans for the future, we are inclined to believe that development in these two directions is to be a feature of automobile shop practice in the next few months.

In the other articles of this series we have dwelt on loss due to enforced idleness of both operators and machines. There are many operations that can be considerably shortened by further applications of rotating work tables and swinging fixtures. An excellent example of what can be done in reducing idle machine time was shown in one large machine in which the table was constructed in removable sections. As each section reached the far end of the machine, the finished piece was removed, the section swung around to the head end once more and a new piece mounted in position. With this arrangement there was no return stroke, all the motion being in one direction and one

might say that the work was practically placed on a conveyor and carried past the cutting elements of the machine.

A number of excellent station type machines for the larger pieces have been worked out and are in effective operation. We have nothing to criticise in these machines, but we do sense the need for machines to do the same type of work on pieces of smaller size. The lack of such machines was evidenced where the big machines were working on pieces decidedly below their capacity.

One thing that we noticed in connection with the handling of work on machines where a long table is loaded while the machine is at rest was that the operators had evidently not been very well instructed as to how to save time in loading and unloading the machine. They got into each other's way by being on the same side of the machine when they should have been on opposite sides, both working on the same piece, the first one to go under the cutting elements. As soon as this piece had been clamped down, the machine could have been started and the operators could have proceeded to clamp the other pieces in their fixtures while the machine was working instead of allowing it to remain at rest until all but the last piece was tightened down.

Another means of reducing idle machine time might be provided in the extra loading fixture for the type of machine in which the rotating table is loaded up with small similar parts. After the cutting operation has been completed it takes an appreciable time to unload the finished pieces and reload with new ones. This idle time can be reduced to a fraction by the use of a loading fixture which could be slid upon the table already loaded and removed when the operation is complete. In the meantime the operator can employ his time in loading the spare fixture.

The automobile industry has been fortunate in having a number of highly specialized tools developed for its particular use. Most of them have been eminently successful, although a few have been so complicated that they were constantly going down for minor repairs and dissipating the savings higher production made possible. Nevertheless, there is room for other special machines, and we cannot but believe that they will be forthcoming before long. Simplicity and ruggedness are the factors most in demand, many of the refinements and adjustments of the tools now in use being of practically no use in the high production shop.

How Are Tools to Be Developed?

There is one question that can be taken up briefly at this point and that is the matter of how these special tools are to be developed. So far as we can find out, the generally accepted custom in the past has been for the automobile manufacturer to let the machine tool builder or his agent, or both together, do the development work on an expensive single-purpose machine and then buy the machine if it happened to meet his requirements. It seems to us that this is not an entirely fair proposition, although it has its advantages from the automobile manufacturer's viewpoint.

One drawback of this method of developing new machinery is that the engineers of the machine tool builder can hardly be expected to produce quite as good results alone as they could if they consulted with and worked in co-operation with the engineers of the automobile manufacturer. There are certain elements in such a design that can only be developed by someone who has been closer to the job for which the machine is intended than the engineer of the machine tool building company. Consequently, the automobile manufacturer does not get quite as good a machine as he would have had his men taken some part in its development. The machine tool builder also suffers because of the possibility of dissatisfaction on the part of the purchaser.

Old Manufacturers Designed Own Tools

In the old days big manufacturers in the machinery field either developed their own special machines or else took their ideas to machine tool builders and asked them to develop them. The Lincoln type miller and the broad wheel grinder are instances of the first mentioned way of developing new machines.

Under present conditions, if the mechanical man of an automobile factory, let's say, should make a suggestion to a machine tool builder for a new machine, it may very well be that his ideas will not meet with favor in the higher regions where control of the expenditures resides. The builder who goes ahead under such conditions is quite likely to find out that the suggestion was made without the authority to purchase and then that the man who made the suggestion has been unable to sell his views, no matter how good they may be mechanically, to the financial man who has the say as to whether the machine shall be bought or not.

If the machine tool builder goes ahead under these conditions he is taking just as much of a chance as if he had originated the idea himself and had risked his money on the soundness of the idea and his ability to sell it.

A situation like the one we have described does not exist generally in other industries. The railroad, for example, that wants a special type of freight car to care for certain unusual classes of freight offered decides what kind of car it wants to meet these conditions and orders that car from a car builder. The car builder does not develop a new design which he thinks may meet such a condition and then try to sell it to the railroad people.

Even with the situation as we have painted it, a machine tool builder is not relieved from the responsibility of keeping his eyes open for opportunities. If he sees a very obvious need for a certain type of tool, it should be a part of his job to take steps to develop that tool. By the same token the automobile producer is not relieved from making his demands known to the man who can supply them. What is needed, apparently, is some means of getting the two principals together. Certainly the agents of the builder may be as far at sea as the mechanical men of the automobile companies when it comes to actual order-producing information as to what is wanted.

There are associations both of machine tool builders and of automobile manufacturers. Perhaps there is an opportunity here for them to co-operate to their mutual advantage.

There are about 25,000,000 car wheels used in railway traffic in the United States to carry 750,000,000,000 gross ton-miles per year. This means 8,000,000 tons of metal divided between chilled cast iron and steel wheels. The great majority of these are chilled.

Applying Production Methods to the Radio Head Set

By RAYMOND FRANCIS YATES

Use of special attachments and fixtures — Coil making procedure—Electrical testing—Mechanical accuracy required — Assembling in fixtures

THE popularity of radio came with such a rush that the manufacturers were caught completely unawares. The demands upon their factories were multiplied many times, and desperate efforts were made to get into production under the most trying conditions. This is a story of the success of one firm,

FIG. 1—ASSEMBLY PRESS FOR BOBBIN CORES

C. Brandes, Inc., which is now manufacturing from 2,500 to 3,000 head sets each day.

The radio head set presents a highly interesting production problem, since the mechanical construction has a great bearing upon the electrical efficiency, as well as the acoustic properties. This will be appreciated the more when it is said that, even with the most careful mechanical manufacture, it is difficult to find two receivers which will have exactly the same acoustic properties. Then again, we get some idea of the delicacy of a good head set when we understand that it requires but 0.00000000016 amp. to give an audible signal.

There is nothing unusual about the forming of the case, and after it is completed the edge of the case is swedged or pinched up to produce a shoulder to take the thread for the receiver cap. Since the material of the case is ⅛-in. stock, it is necesary to produce this extra thickness. The thread is cut on the shoulder with an ordinary geometric diehead. It is necessary to carefully watch the adjustment of the diehead, for it is imperative that the receiver caps fit snugly, so that the diaphragm will be clamped perfectly over the pole pieces. Master gages are used at regular intervals to prevent too much scrapping.

The bobbin cores are blanked out from carefully selected special steel. Even a very small difference in the width of the bobbin or magnet core would cause an appreciable difference in a head set, and consequently it is necessary to test each core in a go and no-go gage. The accuracy must be within 0.0005 in. to pass inspection.

The bobbin heads are blanked out of a special grade of thin bakelite and these slip over the cores. The corners of the core are peaned over a trifle by a specially arranged foot press, illustrated in Fig. 1. It will be noticed that a semi-automatic attachment has been put in place. The bobbin tops are placed in a chute and the operator feeds the cores into the revolving dial with both hands.

Insulation is another important feature of successful receiver manufacture, and it is necessary to place a special grade of insulating tape over the bare steel core of the bobbins before they are passed along to the winding machines. Fig. 2 shows the operation of taping the steel core, and an automatic bobbin winding

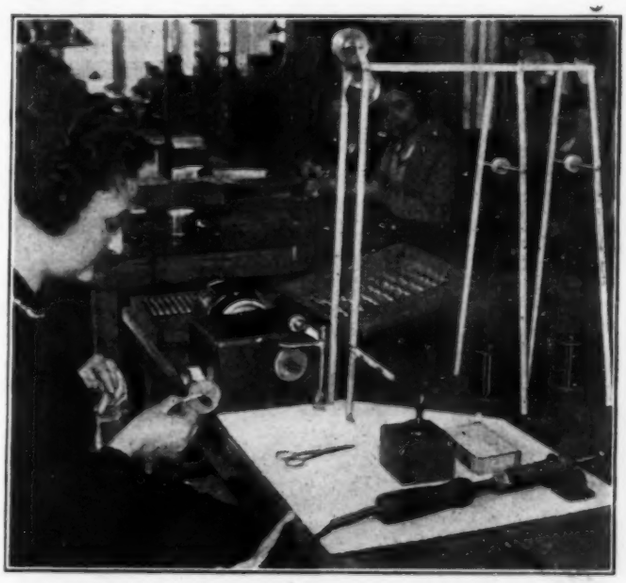


FIG. 2—BOBBIN TAPING AND WINDING

FIG. 3—SOLDERING LEAD WIRES TO COIL

machine with spools of wire, guides and motor. The wire placed on the bobbins is almost as fine as a human hair, and is wound upon the bobbin at the rate of three thousand turns per min. When the proper amount of wire has been placed upon the bobbin, the machine automatically stops. In the meantime the girl operating the machine has prepared a second bobbin and the winding on it is immediately started.

The manufacturer of telephone receivers must be constantly on the alert for grounds or short circuits, since the least electrical defect is apt to cause a partial ground or leakage which will completely destroy the sensitivity of the receiver. Immediately after the bobbins are wound they are tested on a high voltage d.c. circuit to make sure that the winding is in no way grounded. A sensitive indicating instrument is connected in the circuit, and the action of its needle immediately gives the operator a warning.

After the ground test, a very careful resistance test is made, since it is necessary that the resistance of all bobbins be practically uniform. To measure the resistance of each one of these bobbins on a regular Wheatstone bridge would be a tedious task, which would interfere greatly with the progress of manufacture owing to the slowness of the method. Therefore, a direct reading ohmmeter sufficiently accurate for the purpose is used. Like a measuring gage, this ohmmeter is operated on the "go and no-go" principle. Two limit marks are placed on its scale and the indicating needle must fall between them. Variation in resistance must not amount to over 5 per cent, plus or minus.

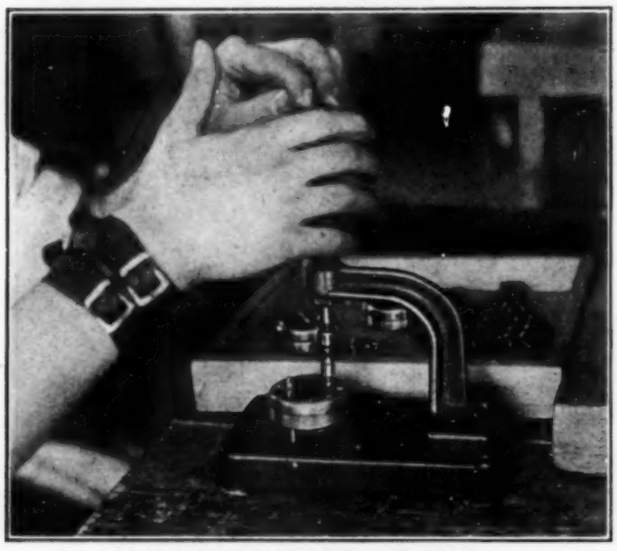


FIG. 4—ASSEMBLY FIXTURE

The next operation of importance is that of soldering on the lead-in wires. This operation is shown in Fig. 3. The molten solder is held in the receptacle at the center of the apparatus illustrated and the flux is in the tube into which the wires are being dipped. If the tiny wires used on the magnets were used to make the connections, they would be sure to break in time and render the receiver useless. To overcome this possibility a heavy lead-in wire is soldered to the fine wire.

The finished bobbins are placed in trays where they are allowed to remain for one month without being disturbed. This ageing process allows the moisture to dissipate thoroughly. At the end of the ageing process, the lead-in wires are clipped and skinned and the bobbins are again given a "ground" and an "open" test. This is to check up any changes that may have taken place during the ageing, and in these tests only the perfect bobbins are acceptable. Every bobbin that shows the faintest trace of ground is rejected.

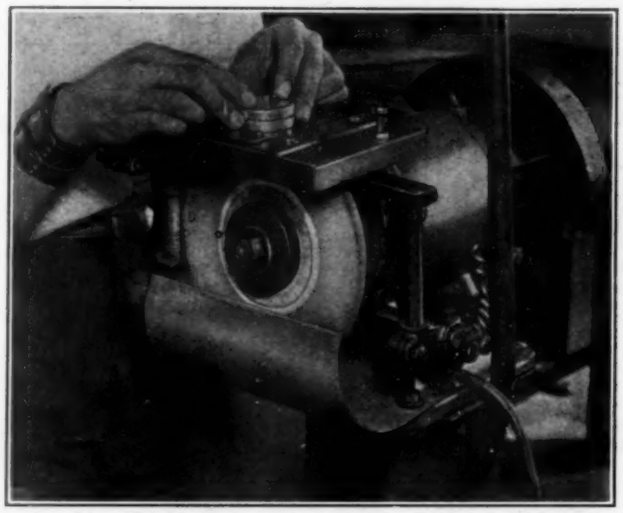


FIG. 5—GRINDING POLE FACES

An assembly fixture, used to assemble the binding posts in the case, is illustrated in Fig. 4. The various parts are assembled in proper position in the fixture and the nuts are tightened by means of the small socket wrench which is mounted in the fixture as shown. The remaining parts of the receiver are assembled in similar fixtures, and the assembly is completed by soldering the lead-in wires to the terminals.

In the completed receiver the pole faces must be exactly 0.002 in. from the diaphragm and this distance must be held between the pole faces and the edge of the case. The operation of grinding the pole faces is done on a surface grinder attachment placed on an ordinary motor-driven grinder as shown in Fig. 5. The distance from pole face to edge of case is measured by means of a depth gage. Should this distance be greater than 0.002 in., another operation is required to remove some metal from the edge of the case.

Analysis of Milled Gears

By ERNEST WILDHABER and EARLE BUCKINGHAM

Determination of error in using cutter of wrong number —Modification of cutting depth—Excess depth of cut for backlash—Eccentric tooth action and edge contact

ONE OF the most widely used methods of machining gear teeth is to mill them with a formed milling cutter. As is well known, this method utilizes a series of eight cutters which are adapted to produce gears with from twelve teeth to a rack, each cutter being utilized to produce a certain part of the series.

In principle, each cutter is correct for the smallest gear in its particular series, and the extent of the series for which each cutter is used depends upon the change in the theoretical form. As these forms change least with greater numbers of teeth, the range of the cutters greatly increases as the tooth numbers increase, as will be noted from the following tabulation:

Cutter	No. Teeth in Gear	Cutter	No. Teeth in Gear
No. 8	12 to 13	No. 4	26 to 34
No. 7	14 to 16	No. 3	35 to 54
No. 6	17 to 20	No. 2	55 to 134
No. 5	21 to 25	No. 1	135 to a rack

Theoretically, a cutter which is correct for a certain number of teeth is incorrect for any other number. Practically, however, this error is slight, and one purpose of this paper is to analyze the nature and amount of such errors.

Furthermore, it often happens that a gear with 23 teeth, for example, is required while the only cutter available is the No. 4 cutter instead of the No. 5 cutter. Another purpose of this paper is to show how this No. 4 cutter can be used with as good or better results by slightly modifying the depth of cut.

Again, it is often desirable to provide more backlash on the gears than is present when the gears are cut to the theoretical depth, and this is accomplished by sinking the cutters deeper into the blank. Theoretically, this operation displaces the profile and alters the action, and another object of this paper is to determine the amount of excess depth for each gear that will give the best results.

A study of the errors introduced, as noted above, will show that they can be reduced and compared to the errors in eccentric gears. The analysis itself is very involved, and requires much study to follow. It will be published some time in the near future, for the benefit of those who enjoy "mental gymnastics," but is omitted here for several reasons. In the first place, the time available is not sufficient to make a clear and complete exposition of the subject; in the second place, the majority of us are not so much interested in the derivation of the various equations as we are in the equations themselves, and their practical application; while in the third place, the inclusion of the involved derivation would tend to obscure the simplicity of the final results.

An analysis will show that if an eccentric gear driving a rack turns uniformly about its axis of rotation, the velocity of the rack will fluctuate according to a pure sine curve. This holds true for any amount of eccentricity.

If an eccentric gear driving a concentric gear turns uniformly about its axis of rotation, the velocity of the concentric gear will fluctuate almost according to a sine curve. When the amount of eccentricity is small (and we are dealing only with relatively small errors in this paper) the variation from the sine curve is so slight that it can be neglected.

If an eccentric gear drives another eccentric gear, the velocity of the driven gear will fluctuate according to two sine curves and, when the tooth numbers and amount of eccentricity are alike on both gears, they may fully compensate for each other. When the tooth numbers are the same but the amount of eccentricity is different, they can be made to partly compensate for each other. In other words, the resulting error will be the same as if one gear only was eccentric, with an error equal to the difference in eccentricity. When the tooth numbers are different, they cannot, as a rule, compensate for each other.

Purely eccentric gears, with small or large eccentricity give a varying but continuous action. Each succeeding tooth takes over the load from the preceding tooth smoothly and without impact. It is not such an action as in gears with spacing errors. Consequently, eccentricity of accurate involute gears does not introduce the action of spacing errors. This smoothness of action requires, of course, a sufficiently long arc of contact, which is also necessary for concentric gears, and the tooth load should be large enough to keep the teeth of the two gears in contact.

The continuity of action of eccentric involute gears can be taken advantage of in making variable motion gears. Eccentric gears of substantial eccentricity and equal tooth numbers make good variable motion gears, particularly if the tooth load during the whole cycle is large enough to keep the teeth in contact.

Error When Milling Too Deep

When a cutter is set to cut deeper than the theoretical depth, the involutes of the cutter no longer correspond to the center of rotation of the blank. The center of the involutes, or their base circle, of each tooth space, is then located beyond the actual center of the gear blank. This causes a somewhat different action of the gear because, instead of having one center

A paper presented at the Fall meeting of the American Gear Manufacturers Association, Lake Mohonk, N. Y., Oct. 25, 1923.

of eccentricity, each tooth space has its own center of eccentricity.

It is quite common in practice to cut too deep, thus introducing the required play or backlash into the gears in order to avoid jamming. The effect of this practice is to give a variable and slower motion to the driven gear. Thus, it has a similar effect to a spacing error, for such a pinion will move its rack too slow. The following tooth also gets into contact too early and with a blow. This premature contact might be called edge contact, inasmuch as the tip edge of the rack does not contact tangentially with the flank of the pinion tooth, but is somewhat tilted. The pressure is thus transmitted through the edge, as long as the tip edge of the rack and the flank of the pinion tooth stand up. Wear takes place rapidly at these spots. Such an edge contact is dangerous and should be avoided, because the rack tends to gouge into the flank of the pinion tooth.

The same relation as for a rack drive holds substantially true for gear drives, where one gear, which is cut too deep, meshes with a correctly cut gear. If the driver is cut too deep the driven gear has the tendency to fall back, and the driver acts as if its normal pitch were too short, every tooth starting with edge contact. On the other hand, if the driven gear is cut too deep, while the teeth of the driver are cut to the correct depth, the driven gear has the tendency to advance. The contact also starts with a blow, which is reduced however, as compared with the previous case, because of the momentum of the moving parts. Moreover, there is no edge contact, since the contact does not start at the bottom of the active face of the driving tooth and the tip of the driven tooth. It starts somewhat above the bottom of the active profile of the driving tooth and below the tip of the driven tooth. This condition is evidently much more favorable than the previous one.

The influence of deeper cutting is dependent upon the number of teeth in the particular gears. Pinions with small tooth numbers are much more sensitive than gears with large tooth numbers. The amount of falling back or advancing of the driven gear is inversely proportional to the number of teeth in the gear which has been cut to a given excess depth. Or, in other words, if in different drives, one gear is always cut to an excess depth which is proportional to its tooth number, then all these drives will contain the same error.

The foregoing refers to cutting one gear of a drive too deep, while its mating gear is cut to correct depth, and using cutters corresponding exactly to the number of teeth in the gears.

By cutting both gears of a drive deeper, the error is partly, or even entirely, compensated for. If two gears are cut with cutters that correspond to their exact tooth numbers, respectively, but are cut to an excess depth proportional to their respective tooth numbers, the errors will then just compensate for each other.

Action of Gears Cut with Formed Cutters Corresponding to Different Tooth Numbers

Cutting gears with different cutters than those which correspond to their exact tooth numbers has two effects. First, it produces a certain drop in the velocity of the driven gear from the first contact to the end of contact. Second, it tends to shift the period of contact ahead, that is, the contact will start at or near the bottom of the active profile on the driver, but will end before it reaches the top of the driving tooth.

In such gears only one tooth can be in contact at a time. In other words, the duration of contact of any one tooth lasts for one tooth interval and no longer. If the tooth profiles are long enough to provide this mesh, this drawback is not very important but, in cases where the tooth profiles are not long enough to provide a sufficiently long action, edge contact will occur. The tip of one tooth will contact with the flank of its mating tooth somewhat at an angle, the tip edge contacting without assistance from the tooth profile.

Such edge contact is dangerous and detrimental. If the mesh starts with edge contact, the flank of the driver tends to be gouged away, and the gears ruined. Edge contact can be restricted by modification of the tooth profiles, but cannot be avoided in all cases.

We have it in our power, however, to make a considerable improvement in the action of these gears by causing one error, such as results from using a range cutter, to compensate to a large extent for another, such as cutting the teeth deeper. In this way we can force the contact toward the middle of the mesh, and always avoid edge contact. At the same time we can always introduce the desired amount of backlash safely.

Hitherto it has been customary to always cut a gear with a cutter corresponding to a smaller tooth number, if no exact tooth number cutter was available. Many drives, however, can be greatly improved by using on one gear a cutter which corresponds to a larger tooth number than the gear, while the other gear is cut in the usual way.

Several simple equations must be solved to obtain this result, in which the following symbols are used:

n = Number of teeth in driving gear
n' = Exact tooth number of cutter for driving gear
d = Difference in tooth number $(n - n')$
N = Number of teeth in driven gear
N' = Exact tooth number of cutter for driven gear
D = Difference in tooth number $(N - N')$
D' = Drop in velocity ratio during mesh
A = Pressure angle
b = Excess depth to cut teeth for compensation
B = Excess depth to give desired backlash
B' = Total excess depth

$$D' = \left(\frac{D}{N \times N'} + \frac{d}{n \times n'}\right) \qquad (1)$$

When n' or N' is larger than n or N, respectively, the values of d or D will be negative. If the cutters are so selected, one of larger tooth number and the other of smaller, that equation 1 becomes equal to zero, true uniform motion gears will be realized. The value of this equation should be kept as small as possible, and positive. Negative values should be avoided. Preferably, the smaller gear is milled with the cutter which corresponds to a larger tooth number, and if desired, additional backlash may be introduced.

The following equations are based on gears of 1 diametral pitch. For different diametral pitches, we divide the results by the required diametral pitch.

$$b = \frac{\pi}{4} \tan A n' \left(\frac{D}{N \times N'} - \frac{d}{n \times n'}\right) \qquad (2)$$

If the value of b is negative, this would indicate that the pinion should be cut that amount shallower than standard.

Equation 2 becomes the following, when $A = 14\frac{1}{2}$ deg:

$$b = 0.20312 n' \left(\frac{D}{N \times N'} - \frac{d}{n \times n'}\right)$$

For simplification, the factor 0.20312 may be reduced to 0.20, which will give sufficiently accurate results, whence

$$b = 0.2n' \left(\frac{D}{N \times N'} - \frac{d}{n \times n'}\right) \quad (3)$$

$$B = \frac{\text{Desired backlash}}{2 \times \tan A}$$

For a 14½-deg. pressure angle, this equation reduces to

$$B = 1.93336 \times \text{Desired backlash}$$

For simplification, the factor 1.93336 will be called 2, which will give sufficiently accurate results, whence

$$B = 2 \times \text{Desired backlash} \quad (4)$$

The total excess depths to cut the gears, making the allowance for backlash, and compensating for the cutters used, are given in the following equations:

$$\text{(For driving gear)} \quad B' = B - (B - b)\frac{N'}{N' + n'} \quad (5)$$

$$\text{(For driven gear)} \quad B' = (B - b)\frac{N'}{N' + n'} \quad (6)$$

The above equations for the excess depth may be used as long as both excess depths are positive; b itself may be positive or negative.

We will illustrate the use of the foregoing equations with a few definite examples, and the first example will be the following:

16-tooth pinion, 29-tooth gear, 6 d.p., 0.010 in. backlash.

The 16-tooth pinion will be cut with a No. 6 cutter (17 teeth) and the 29-tooth gear with a No. 4 cutter (26 teeth). The backlash, corresponding to 1 d.p. equals $6 \times 0.010 = 0.060$ in. Thus we have the following numerical values:

$$\begin{aligned} n &= 16 \\ n' &= 17 \\ d &= -1 \\ N &= 29 \\ N' &= 26 \\ D &= 3 \\ A &= 14\tfrac{1}{2} \end{aligned}$$

Referring to equation 1,

$$D' = \frac{3}{29 \times 26} - \frac{1}{16 \times 17} = \frac{3}{754} - \frac{1}{272}$$
$$= 0.003979 - 0.003676 = 0.000303$$

This value is small and positive, and is therefore satisfactory. Referring to equation 3,

$$b = 3.4 \left(\frac{3}{29 \times 26} + \frac{1}{16 \times 17}\right) = 3.4 \times 0.007655$$
$$= 0.02603 \text{ in.}$$

Referring to equation 4,

$$B = 2 \times 0.060 = 0.120 \text{ in.}$$

Referring to equation 5, we have for the excess depth to cut the 16-tooth pinion,

$$B' = 0.120 - (0.120 - 0.02603)\frac{26}{26 + 17} = 0.120 -$$
$$(0.09397 \times 0.60465) = 0.06318 \text{ in.}$$

Reduced to 6 d.p., this excess depth becomes

$$\frac{B'}{6} = 0.0105 \text{ in.}$$

Referring to equation 6, we have for the excess depth to cut the 29-tooth gear,

$$B' = (0.120 - 0.02603)\frac{26}{26 + 17}$$
$$= 0.05682 \text{ in.}$$

Reduced to 6 d.p., this excess depth becomes

$$\frac{B'}{6} = 0.0095 \text{ in.}$$

In this same example, the 16-tooth pinion could be cut with a No. 7 cutter (14 teeth), and in this case we would have the following:

$$n' = 14$$
$$d = 2$$

All other values would be unchanged, and referring to equation 1, we have

$$D' = \frac{3}{29 \times 26} + \frac{2}{16 \times 14} = \frac{3}{754} + \frac{1}{112}$$
$$= 0.003979 + 0.008928 = 0.012907$$

The value of D' is a measure of the variation in velocity during one pitch movement of the gears. This last value of D' is over forty times greater than the first one, and the first solution, therefore, will produce a much better running pair of gears than the second. This pair can be greatly improved, nevertheless, by the proper distribution of the excess depth of cut.

Referring to equation 3,

$$b = 2.8 \left(\frac{3}{29 \times 26} - \frac{2}{16 \times 14}\right)$$
$$= 2.8 \times (-0.004949) = -0.01386$$

Referring to equation 5, we have for the excess depth to cut the 16-tooth pinion,

$$B' = 0.120 - (0.120 + 0.01386)\frac{26}{26 + 14}$$
$$= 0.120 - (0.13386 \times 0.65) = 0.03300 \text{ in.}$$

Reduced to 6 d.p., this excess depth becomes 0.0055 in. Referring to equation 6, we have for the excess depth to cut the 29-tooth gear,

$$B' = (0.120 + 0.01386)\frac{26}{26 + 14} = 0.08700 \text{ in.}$$

Reduced to 6 d.p., this excess depth becomes 0.0145 in.

These examples should be sufficient to indicate the use of the foregoing equations. One word of caution, however, should be uttered. When the tooth number of the cutters are both smaller than the tooth numbers of the gears, edge contact seldom occurs, whether or not a correction is made for the depth of cut. On the other hand, if the tooth number of the cutter is larger than the tooth number of the gear, edge contact will occur unless the correction as outlined above is made for the depth of cut.

The foregoing analysis is an approximate one only. The approximations obtained, however, are extremely close, and sufficiently accurate for all practical results. It is an analysis of milled gears and, primarily, involute gears, for modifications of the involute have not been taken into account, and do not need to be. The modifications, intentional and otherwise, are relatively small quantities and do not require an extremely accurate determination. What is required, however, is a simple solution if it is to have any great practical value.

In addition to the determination of errors, the analysis also provides remedies. It develops a distribution of backlash which avoids errors ordinarily incurred through cutting deeper. It shows how the contact may be prevented from shifting too much, either towards the bottoms or to the tips of the teeth. It permits the use of compensating cutters, by making one error modify another.

One of the general and important gear problems is how to avoid safely edge contact at the beginning of mesh. It is particularly dangerous for the tip edge of the driven tooth to have contact with the flank of the driving tooth. When this danger exists in milled gears, for instance with low tooth numbers, through lack of accuracy in cutting, it may always be avoided by cutting the driven gear a trifle deeper.

Endurance Tests of Molybdenum Steels

THAT molybdenum is one of the most powerful and useful alloying elements in steel is stated by the Department of the Interior to have been conclusively demonstrated by experiments conducted by Dr. H. W. Gillett, chief alloy chemist, Department of the Interior, at the Ithaca, N. Y., field office of the Bureau of Mines. While the value of molybdenum as a steel alloy is only beginning to be appreciated and its commercial use is still relatively small, the Bureau of Mines considers that it is destined to become widely used, as it deserves to be. The United States has abundant supplies of molybdenum, which should be made to replace or supplement other metals used as steel alloying elements and which at present must be imported.

Fatigue Qualities Not Incomparable

The early claims of molybdenum as a specific against fatigue failure of steel, which alleged that molybdenum steels were vastly superior to other steels to resist vibration, have not been substantiated in the over-enthusiastic form in which they were made. The experiments of the Bureau of Mines show that, with one exception, molybdenum steels and other alloy steels containing nickel, chromium, vanadium, or a combination of these elements, have equal qualities of endurance, and that no one alloy steel stands out above the others on this score.

The exception is in favor of heat-treated molybdenum steels, for the presence of molybdenum makes the steel require a higher temperature in the drawing or tempering process after quenching, and this higher temperature causes fuller release of quenching stresses. The presence of quenching stresses tends to cause poorer performance under repeated vibration. This factor, however, is not very important, and has a noticeable effect only in very hard steels, for example, those of spring temper. For ordinary structural uses, no alloy steel is appreciably superior for use against vibration to any other when the steels are used in such sizes that they harden throughout on quenching. Molybdenum and certain combinations of nickel and chromium confer depth-hardening properties on steel, and hence they have advantages for use in parts of large cross-section.

Thus it is evident that, as regards endurance, molybdenum steels are the equals of any, and on some scores have slight advantages, but the advantages are slight instead of large. The choice of a composition of an alloy steel will therefore seldom depend on its fatigue properties.

Corroboration of Illinois Experiments

The endurance work of the Bureau of Mines has given results which in general fit in very well with the recent work of the Engineering Experiment Station of the University of Illinois, and which indicate that the conclusions of the Illinois investigation may be extended to apply to a large range of alloy steels.

But, beside corroborating and extending the Illinois results, the work of the Bureau has brought out a point which has not been covered completely by other investigators in this country or abroad, although it has been considered to some extent by most workers in this field. This point is the evil effect on endurance of non-metallic inclusions. Dirty steel gives far less uniform results on endurance tests than cleaner steel, and dirty steel is certainly unreliable and unsafe where repeated vibration must be endured.

These inclusions, or other similar imhomogeneities in the metal, are probably the cause of many failures in service. From the relationship worked out by the Illinois investigators and others, and corroborated by the Bureau of Mine tests, the endurance properties of any really clean steel may be quite safely predicted. But when the steel is not clean, it may give either the same results as a clean steel, or far poorer results, depending on whether the most severely stressed spot in a piece made from the dirty steel happens to be locally clean or locally dirty.

Investigating the Effect of Inclusions

The problem of the exact effect of different inclusions or inhomogeneities in steel and other alloys, and the larger problem of how to produce clean steel and alloys, are of vital importance, and involve many factors in the preparation of metallic products, ranging from the methods of elimination of impurities from the ores, down through the smelting of the metals and the melting of the alloys. Much scientific data needed for a proper understanding of the problem is lacking.

To obtain further information on the effect of inclusions, comparisons are being made of endurance tests on specimens cut both with and across the direction of rolling, since the latter, or transverse specimens, usually show the bad effect of inclusions and inhomogeneities most markedly. As soon as the endurance tests on the series of molybdenum, cerium and comparison steels are completed, tests will be made on a series of nickel-silicon steels previously made by the Bureau of Mines for the Navy, and on which tests made by the Navy on properties other than endurance are available. The Navy has supplied specimens cut both longitudinally and transversely, and the Bureau has prepared all these specimens for testing. This work should throw some light on the problem of inclusions. But work with inhomogeneities such as inclusions in steel is difficult because of the irregularity of distribution of the inclusions.

Endurance Tests Being Run Continuously

In order to study the effect of different kinds of inhomogeneities in different sorts of alloys, work on certain non-ferrous alloys has been begun.

Prior to the fiscal year of 1922-1923 a series of fifty molybdenum, cerium and other alloy steels was prepared for comparative purposes, and the necessary tests, other than endurance tests, were made. After these cooperative agreements ended, the Bureau of Mines continued the endurance tests in order to make the work complete. Endurance tests are time-consuming, and, save for a short period when the machines were out of commission due to a fire which damaged the laboratory of Sibley College, Cornell University, in which the endurance machines used in this work are located, two endurance machines have been run night and day throughout the present year. These machines will continue to run continuously for a few months longer to complete the program.

Cerium offers no promise of usefulness as an alloying element in steel. Its use tends towards the presence of non-metallic inclusions and toward troubles consequent upon this defect.

German Standards for Tolerances and Allowances in Machine Fits

BY OSCAR R. WIKANDER

LONGITUDNAL dimensions are treated in very much the same way as diameters in regard to fits and tolerances. The basic size is used as one limit of the tolerance field and either the unit bore or the unit shaft system can be used.

In case a number of longitudinal dimensions form a certain total, it is, of course, not permissible to prescribe tolerances for the dimension of each part and for the total as well. If tolerances are prescribed for the total, at least one of its component parts must not be dimensioned with tolerance limits.

It is, of course, desirable to use such variations for bores and shafts of standard parts, that they can be made in quantity production in specialized shops and used in combination with the unit bore or the unit shaft system. without discrimination. Standard parts, which are always used with the same fit, should be so dimensioned that:

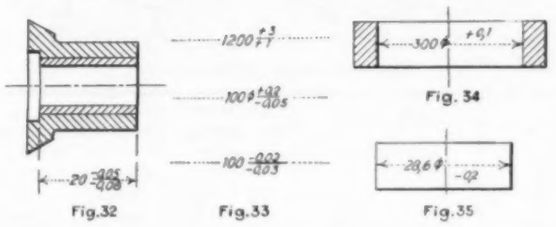
1. All bore variations correspond to the desired fit in the unit shaft system.
2. All shaft variations correspond to the desired fit in the unit bore system.

The user can then always manufacture the mating parts according to his own gages, regardless of whether he is equipped for the unit bore or the unit shaft systems. In regard to standard parts to be used with different fits, it is impossible to dimension a bore so that it will give more than *one* fit in the unit shaft system or a shaft so that it will give more than *one* fit in the unit bore system.

Annular ball bearings and certain types of roller bearings, have a unique position among standard parts. The standardized dimensions of the current commercial sizes are the same, and the variations of their bores and outside dimensions are practically the same, in all countries. Their tolerances are closer than in any of the German standard grades of fits. The fits to be used for such bearings have not yet been standardized, though the recommendations of the various manufacturers agree fairly well.

For the measurement of shafts, snap gages are used for the entire range from 1 to 500 mm., while for the

DIN | **Drawings** — **Indication of Tolerances and Fits** | **DINORM 406** Sheet 5



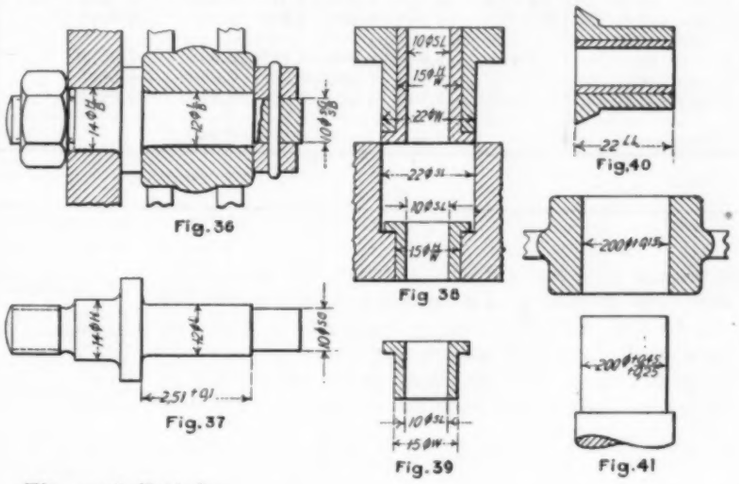
Tolerances are indicated by means of the basic size with the upper and lower variations (see Figs. 32 and 33).

If the basic size is equal to the minimum size (Example: bores, keyways), the latter and the tolerance are given (see Fig. 34).

If the basic size is equal to the maximum size (Example: shafts, keys), the latter and the tolerance are given (see Fig. 35).

The variation O is omitted (see Figs. 34 and 35).

The variations are given behind the dimension, in case of diameters behind the diameter sign, the upper variation always above and the lower variation always below the dimension line (see Fig. 33).



Fits are indicated:

1—By the abbreviations, according to DIN 776 (see Figs. 36 to 40), or

2—By the basic size and the variations for the two mating members (see Fig. 41).

The abbreviations or symbols are written to the right of the dimension, a little above the latter, or, in case of diameters, behind the diameter sign (see Figs. 36 to 40). Example: 22 ϕ *SL* means: 22 millimeter diameter, Schlichtlaufsitz.

If the dimensions for the bore and the shaft are indicated by one dimension only (see Figs. 36 and 38), the symbol for unit bore (see Fig. 36) or for unit shaft (see Fig. 37), is placed below the symbol for the fit. Example: 15 $\phi \frac{H}{W}$ means: 15 mm. bore, Haftsitz, unit shaft, and 15 mm. outside diameter of the shaft, unit shaft.

The same indications of the fits can be used for flat fits as well (see Fig. 40).

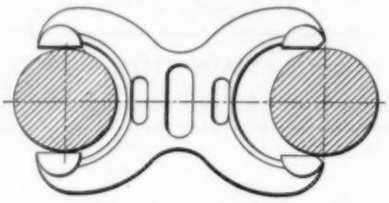
Copyright by Normenausschuss der Deutschen Industrie

DIN | **Enger Laufsitz** — Fine Grade of Fit — Unit Bore | **DINORM 22**

Symbol for Enger Laufsitz: *EL*

The "Enger Laufsitz" is used for mating parts, which should be able to move in relation to each other without noticeable looseness.

"Go" End
The gage should slip over the shaft by its own weight.



"No Go" End
The gage must not go over the shaft, but at the most hold on to it.

Dimensions in Millimeters

Range, Inches	New Gage Variations: Upper "Go" End	New Gage Variations: Lower "No Go" End	Calculated Looseness Between Bore and Shaft for New Gages: Max.	Calculated Looseness Between Bore and Shaft for New Gages: Min.	Worm Gage "Go" End: Permissible Wear	Worm Gage "Go" End: Variation	Kind of Gage
..... 1 to 3	—0.003	—0.008	0.016	0.003	0.0015	—0.0015	
Above 3 to 6	—0.004	—0.012	0.024	0.004	0.0020	—0.0020	
Above 6 to 10	—0.005	—0.015	0.030	0.005	0.0025	—0.0025	
Above 10 to 18	—0.006	—0.018	0.036	0.006	0.0030	—0.0030	
Above 18 to 30	—0.008	—0.022	0.044	0.008	0.0040	—0.0040	
Above 30 to 50	—0.009	—0.025	0.050	0.009	0.0045	—0.0045	
Above 50 to 80	—0.010	—0.030	0.060	0.010	0.0050	—0.0050	Snap Gages
Above 80 to 120	—0.011	—0.035	0.070	0.011	0.0060	—0.0050	
Above 120 to 180	—0.013	—0.040	0.080	0.013	0.0070	—0.0060	
Above 180 to 260	—0.015	—0.045	0.090	0.015	0.0080	—0.0070	
Above 260 to 360	—0.018	—0.050	0.100	0.018	0.0090	—0.0090	
Above 360 to 500	—0.020	—0.060	0.120	0.020	0.0100	—0.0100	
Tolerance Units	—0.5	1.5	3.	0.5	0.25	.....	

October 16, 1919

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measurement of bores, cylindrical plugs are used up to 100 mm. bore inclusive. Flat gages are used above 100 mm. up to 260 mm. inclusive, and pin gages with ball ends are used above 260 millimeters.

The permissible wear of shop gages, expressed in tolerance units (*PE*), has been standardized as follows:

Gage tolerance in *PE*	1	1.5	2	2.5	3	3.5	5.5	5.5	10
Permissible wear *PE*	0.25	0.35	0.4	0.5	0.6	0.6	0.6	0.6	1.5

All gages are measured at the standard temperature of 20 deg. C. or 68 deg. Fahrenheit.

Some time ago the Sectional Committee on Plain Gages, published its proposed standards of tolerances and allowances in machine fits (*American Machinist*, page 70, Vol. 57) and it may be of interest to compare the proposed American to the adopted German standards. Both are based on the same standard temperature of 20 deg. C. or 68 deg. F. Both have adopted the basic size as at least *one* tolerance limit for every class of fits. This arrangement has many advantages and it is probable that it will be internationally adopted.

The German standards are more complete than those of any other country in respect to the following several items:

1. They have *four* different grades of fits, each containing several classes of fits, while the American standards have only *one* grade.

2. They have two complete systems of fits, the unit bore and the unit shaft systems, while the proposed American standards limit themselves to the former.

In the German as well as the American standards, the tolerances of each class of fits are proportional to the cube root of the basic size, $\sqrt[3]{D}$, where D is the shaft or bore diameter in millimeters.

In the German standards all allowances, except those for press fits and shrink fits, are proportional to this same function, $\sqrt[3]{D}$, while in the American standards, the allowances for loose fits are proportional to $\sqrt[3]{D^2}$, and those for tight fits are proportional to D.

It is obvious that the German practice to use the same function of the diameter to express tolerances as well as fits, makes for a greater uniformity. Considering, however, that tolerances and fits are quantities of different nature, there may be good reasons for the American practice to let each vary according to the function of the diameter which appears most suitable.

The various German classes of fits do not exactly correspond to any of the proposed American ones and, in order to avoid confusion, we have not attempted to translate the German names for the various classes of fits.

The proposed American classes of fits correspond, however, very closely to the following German ones:

Proposed American Standards: Class of Fit	Symbol	Adopted German Standards: Class of Fit	Symbol
Loose fit	I	Weiter schlichtlaufsitz	sWL
Free fit	II-A	Leichter laufsitz	LL
Medium fit	II-B	Laufsitz	L
Snug fit	III-A	Edelgleitsitz	eG
Wringing fit	III-B	Edelhaftsitz	eH
Tight fit	IV-A	Edelfestsitz	eF
Medium force fit	IV-B	Edelpressitz	eP
Heavy force fit	IV-C	Pressitz	P

In view of the facts that:

1. The proposed American standards have been carefully worked out by the leading experts of the United States;

2. They are equivalent, for all practical purposes, to certain of the German standards, which have been adopted upon the recommendation of the foremost German experts;

3. The American proposals check and confirm the results obtained by the German investigators;

4. The German standard fits and tolerances have stood the test of practical application for a few years and have met with the unqualified approval of the affected industries.

The following suggestions may be worthy of consideration:

1. That we accept as American standards, the exist-

ing adopted German equivalents of such machine tolerances, allowances and fits as have been proposed by the Plain Gages Committee of the American Society of Mechanical Engineers.

2. That said Committee be requested to investigate whether such adopted German standards as do not as yet have any equivalents among the proposed American standards, are of sufficient value or importance to be acceptable as anticipatory American standards.

3. That it also be investigated, whether it would not be practicable to use the German symbols for such tolerances, allowances and fits and to adopt the standardized German method of marking the drawings.

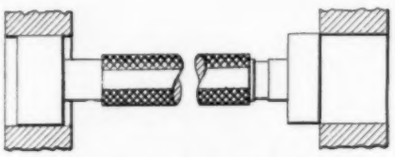
If the American and German standards for tolerances, allowances and fits were identical, and a uniform method of marking drawings were accepted, the engineering intercourse between said countries would be facilitated, and it appears probable that such an agreement would lay the foundation to international standardization in this young, but very important branch of mechanical engineering.

DIN	**Haftsitz** **Fine Grade Fit** **Unit Shaft**	DINORM 46

Symbol for "Haftsitz": *H.*

The "Haftsitz" is used for mating parts, which should hold on to each other, but which can be put together or taken apart without great effort. They must be locked in order to prevent turning or axial displacement in relation to each other.

"Go" End
The plug must enter without much effort.



"No Go" End
The plug must not enter the hole, but at the most hold on it.

Dimensions in Millimeters

Range, Inches	New Gage Variations: Upper "Go" End	New Gage Variations: Lower "No Go" End	Calculated Looseness Between Bore and Shaft for New Gages: Max.	Calculated Looseness Between Bore and Shaft for New Gages: Min.	Worm Gage "Go" End: Permissible Wear	Worm Gage "Go" End: Variation	Kind of Gage
1 to 3	+0.003	—0.005	0.008	0.005	0.0020	—0.0070	Plug Gage
Above 3 to 6	+0.004	—0.008	0.012	0.008	0.0030	—0.0110	
Above 6 to 10	+0.005	—0.010	0.015	0.010	0.0035	—0.0135	
Above 10 to 18	+0.006	—0.012	0.018	0.012	0.0040	—0.0160	
Above 18 to 30	+0.008	—0.015	0.023	0.015	0.0050	—0.0200	
Above 30 to 50	+0.009	—0.018	0.027	0.018	0.0060	—0.0240	
Above 50 to 80	+0.010	—0.020	0.030	0.020	0.0070	—0.0270	
Above 80 to 120	+0.011	—0.022	0.033	0.022	0.0080	—0.0300	Flat Gage
Above 120 to 180	+0.013	—0.025	0.038	0.025	0.0090	—0.0340	
Above 180 to 260	+0.015	—0.030	0.045	0.030	0.0100	—0.0400	
Above 260 to 360	+0.018	—0.035	0.053	0.035	0.0120	—0.0470	Ball Gage[1]
Above 360 to 500	+0.020	—0.040	0.060	0.040	0.0140	—0.0540	
Tolerance Units	+0.5	—1	1.5	1	0.35	—1.35	

[1]When Flat or Ball Gages are used, the resulting fits are sometimes slightly tighter than when plug gages are used.

If great uniformity in the manufacture is desired in case of a "Haftsitz," it is recommended to use "Edelhaftsitz," according to Dinorm 50.
October 16, 1919.

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Teach Your Boy a Trade—Discussion

BY FRED J. SCHLEGEL, JR.

Having read several articles in the *American Machinist* since this subject has been under discussion, bemoaning the fact that more young men do not become apprentice machinists, I would like to offer my opinion. I served an apprenticeship at this honorable trade, during the time big wages were made in shops having war contracts, and am not working at it now.

One machine that I worked on is now operated by a man, being paid full machinist's wages, who never saw the inside of a machine shop before he secured a job in one as a machine hand during the war. Another man in the same shop, who has been specialized in a certain line of work, is now making 25 cents an hour more, on an average, than the average machinist's wages, and doing it easier than they can. He never served an apprenticeship. Can you blame a man who has been an apprentice and must work under these conditions for advising young fellows not to waste their time serving an apprenticeship?

Then look at the money that can be earned at bricklaying, plastering, carpentry, etc. None of these mechanics work any harder than the machinist, and theirs is a cleaner job. However, I know more than one young fellow who has had a clerical position and left it for one which meant he would have a dirty job but earn more money. It is not dirt that most are afraid of, it is money they want. Of course there are exceptions to this, but I think the greatest drawback is the lowness of wages paid machinists as compared to that received by skilled and even semi-skilled labor in other lines.

I feel that the time I spent as an apprentice was a large loss financially, for I believe I would be just as well off mechanically speaking, as I am now, had I taken a position as a handy man or machine hand in a machine shop, in the same way some are now breaking into the ranks of the machinists. At least most of them are being paid machinist's wages.

A machinist has an interesting line of work but you can't expect him to work for exercise all his life.

The Relation Between Inches and Millimeters

By H. W. Bearce
U. S. Bureau of Standards, Washington, D. C.

IN MANY discussions of the relation between inches and millimeters confusion has arisen as a result of failure to distinguish clearly between differences arising from the use of different fundamental definitions of the units, and those arising from the use of different standard temperatures for physical standards.

Since 1893, the legal relation between the metric and customary units of length in the United States has been that contained in the United States Law of 1866, and put into official use by the so-called Mendenhall Order of 1893. That relation is:

1 meter = 39.37 inches

In Great Britain the legal relation is that established by the Order in Council of 1898, namely:

1 meter = 39.370113 inches

It is apparent, therefore, that there is a slight difference in the relation of the inch and millimeter of the United States and that of the inch and millimeter of Great Britain. For the present purpose it is immaterial whether this difference is the result of the use of a different inch or a different millimeter in the two cases.

The above difference is very small and for most purposes may be entirely disregarded. It amounts to only about one part in 400,000 or 0.18 in. in a mile. This difference results from a difference in definition of the fundamental units, and is fixed and entirely independent of temperature or other physical considerations.

Co-operation of Nations Advisable

The United States and Great Britain can be brought together in this respect only by a change in the legal relation on the part of one or the other or both, and the adoption of a single basic relation.

The only difference referred to, namely, that arising from the use of different standard temperatures, is much more serious, especially from the standpoint of interchangeable manufacture. Strictly speaking it does not involve the relation between inches and millimeters, though often confused with it.

Material standards of length, in general, can have their correct nominal length only at a single temperature. In the United States industrial length-standards, such as gages, precision gage blocks, etc., are usually made to have their correct nominal length at a temperature of 68 deg. F. (20 deg. C.). In Great Britain they are usually made to be correct at 62 deg. F. (16⅔ deg. C.), while in Europe they are generally made to be correct at 20 deg. C. (68 deg. F.), except in France where 0 deg. C. (32 deg. F.) is widely used.

Gage Temperatures Should be Uniform

The result of this lack of agreement as to standard temperature is that accurately machined parts, when made to be correct at different temperatures, will not fit together properly even though of the same nominal dimensions. For example, a part measured with a gage or measuring machine, the standard temperature of which is 20 deg. C., will not fit when mated with a part measured in terms of a standard which is correct at 0 deg. C. This is obviously true whether the parts are measured in inches or in millimeters, or one in inches and the other in millimeters. If the two parts in question have the correct dimensions at the temperature at which they are expected to fit and function properly, then they will fit and function properly at that temperature. While if one is correct at one temperature and the other at another they will not fit and function properly regardless of the units of measurement employed.

This failure to fit is the result of expansion of the measuring instruments and of the materials measured, and can not be avoided except by making the parts of correct size at the same temperature. This can be done most conveniently by making all industrial standards, gages, etc., correct at the same temperature.

Attempts of European Standardizing Bodies

Within the past few years certain European standardizing bodies have attempted to establish a fictitious relation between inches and millimeters, such that machined parts when measured with tools graduated in terms of this relation, would fit interchangeably. Such an attempt serves only to complicate and confuse and can result only in failure.

The difficulties can be completely overcome by the adoption of two simple steps, as follows:

The adoption of a single fundamental relation between inches and millimeters.

The adoption of a single standard temperature at which industrial standards of length, and accurately machined parts shall have their correct nominal dimensions.

The most logical, convenient and generally acceptable relation between the units would undoubtedly be 1 in. = 25.4 millimeters.

The adoption of this relation would involve a slight change on the part of both the United States and Great Britain, but it is believed that the advantages to be derived from uniformity would more than compensate for the temporary inconvenience of the change.

The most widely acceptable standard temperature would undoubtedly be 20 deg. C. (68 deg. F.). This temperature is already widely used in Austria, Germany, Holland, Sweden, Switzerland and the United States. In Great Britain 62 deg. F. (16⅔ deg. C.), and in France 0 deg. C. (32 deg. F.) are generally accepted as the correct standard temperatures.

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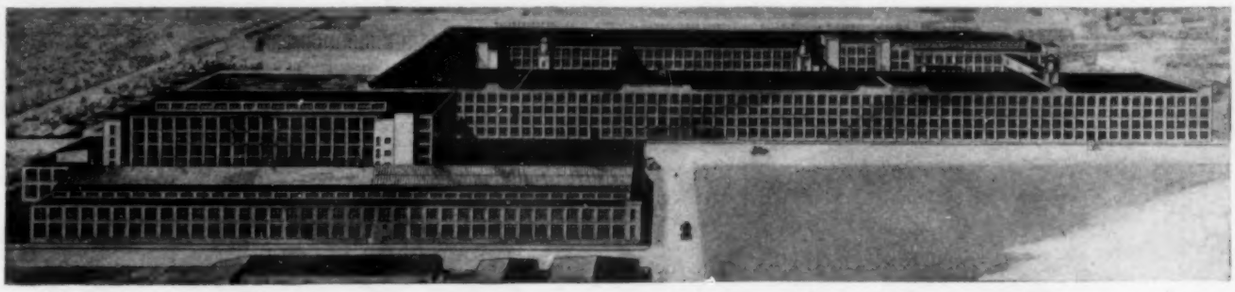
Spiral Bevel Gears Which Can Be Hobbed —Discussion

By W. H. Rasche

The "important kinematical property" of the Archimedean spiral of which Nikola Trbojevich makes such good use in his interesting article, "Spiral Bevel Gears Which Can Be Hobbed," and which he thinks he was the first to notice, was discovered many years ago by Prof. F. N. Willson of Princeton University. See page 64 of "Theoretical and Practical Graphics," by Willson, the MacMillan Co., 1898.

Thus, again, is illustrated the fact that a becloistered scientific theorem which seems utterly irrevelant to practice today becomes of transcendent importance thereto tomorrow.



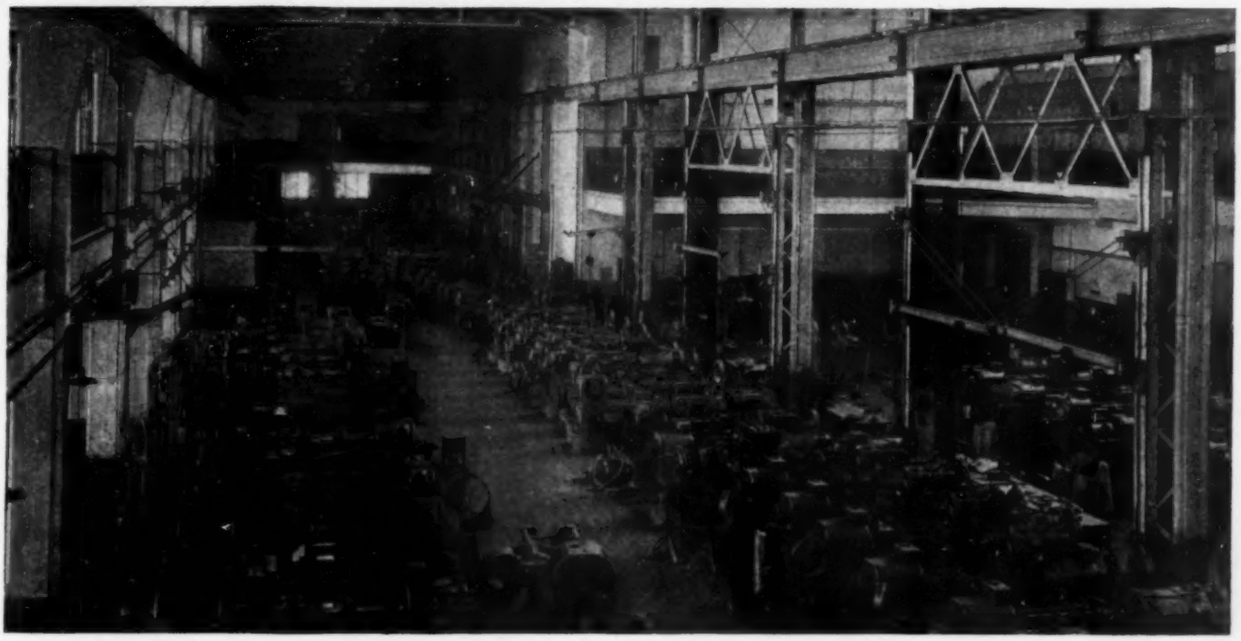
Where Machine Tools Are Made

The National Acme Company

Stanton Ave. Plant, Cleveland

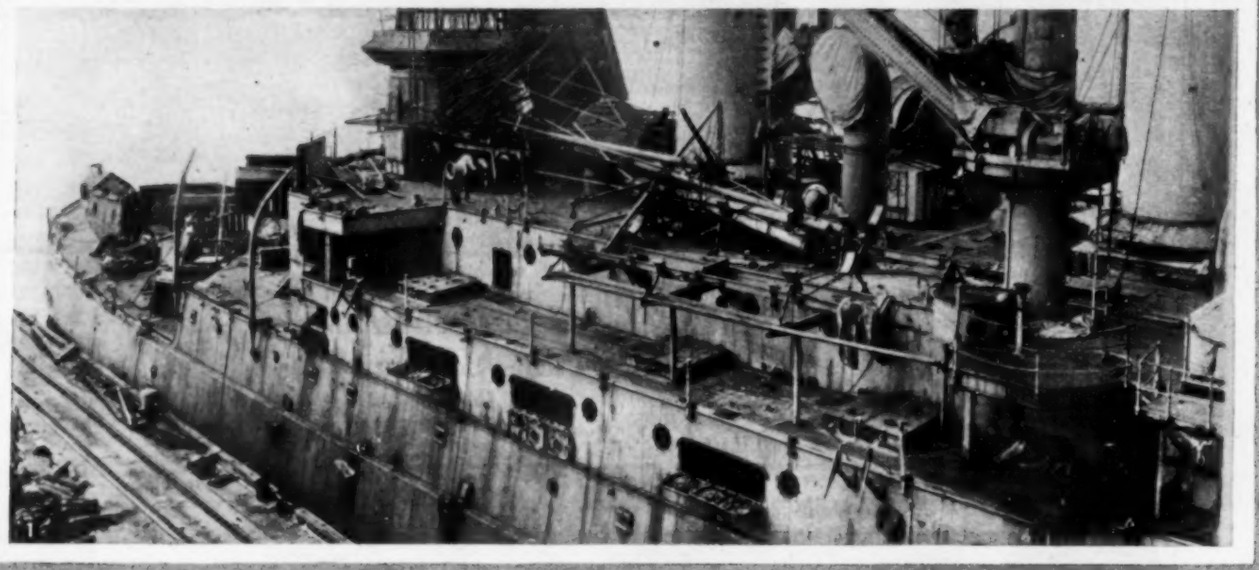
Founded 1897

Crane Room Where Large Acme Automatics Are Assembled



Where Large Castings Are Machined

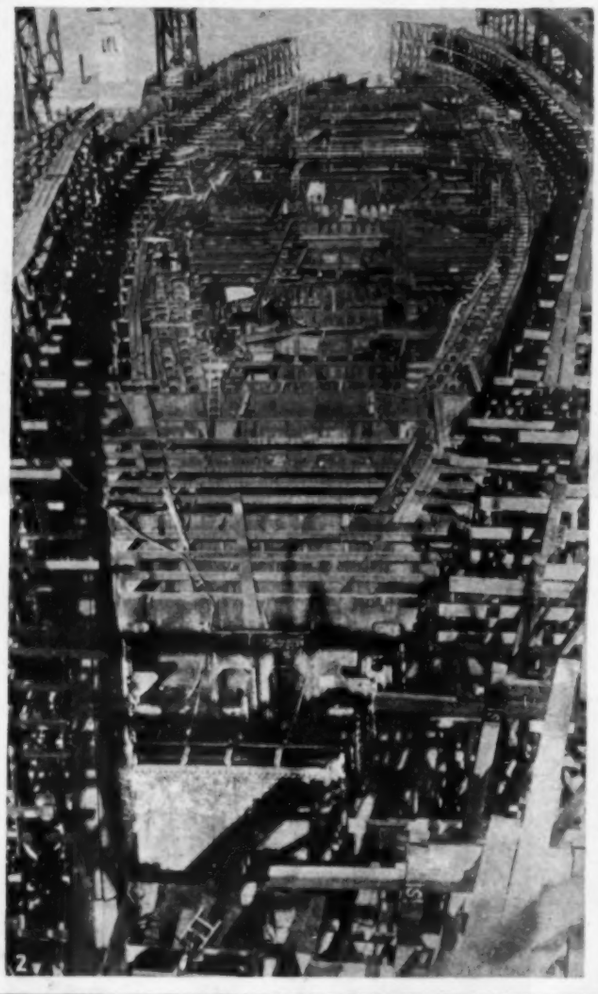
A Battery of Multiple Drills

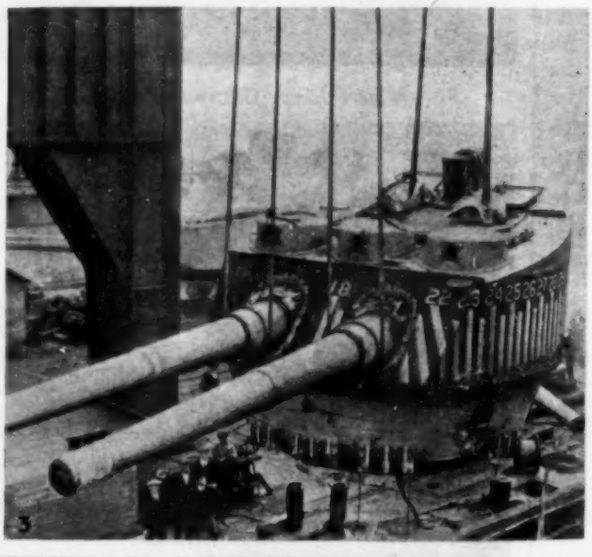


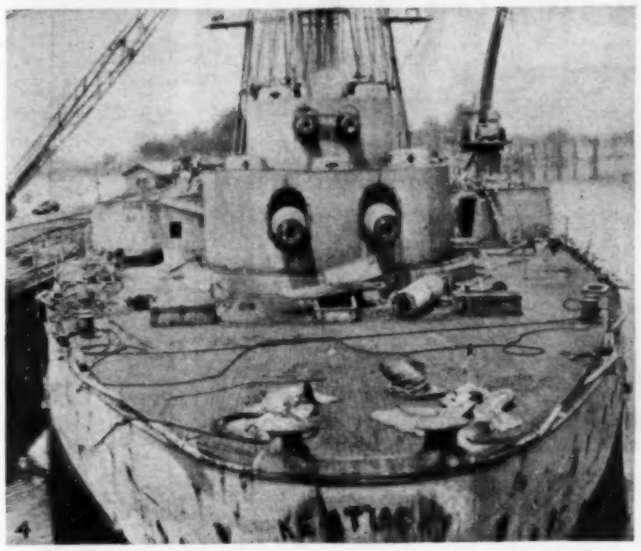
Carrying Out the Terms

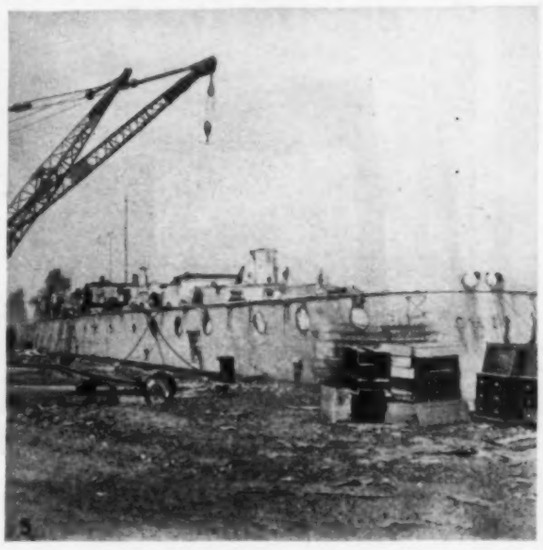
The U.S. Navy Department is selling for cruisers, some of which have

1—After deck of the U.S.S. Michigan as dismantled and ready for sale as scrap.
2—The U.S.S. Montana, one of the ships being scrapped before completion.
3—How a 350-ton crane landed a turret carrying 8 inch guns.
4—Starting salvage work on a battleship.





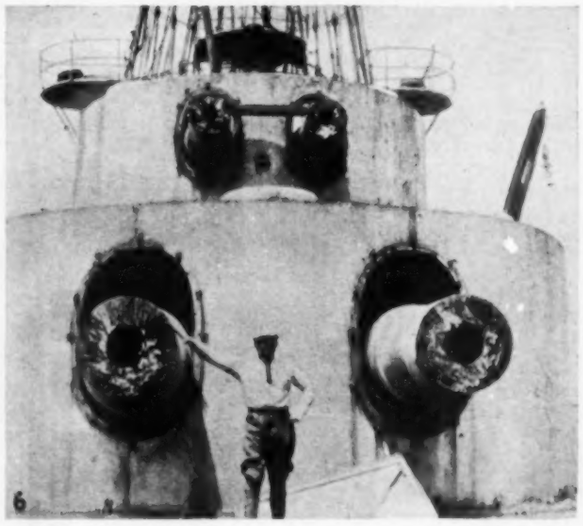


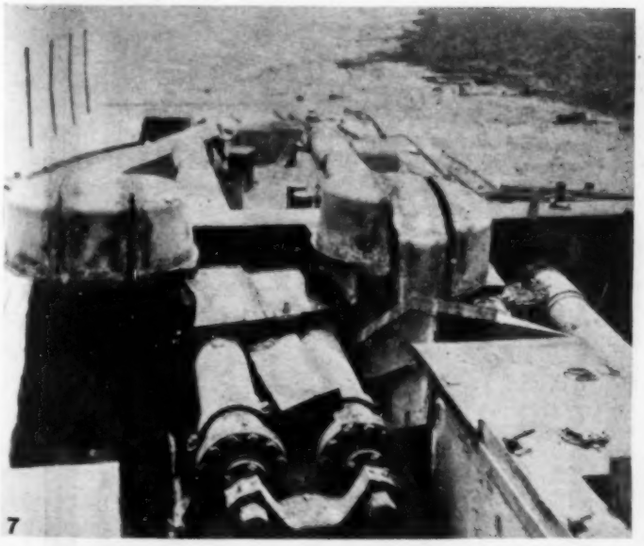


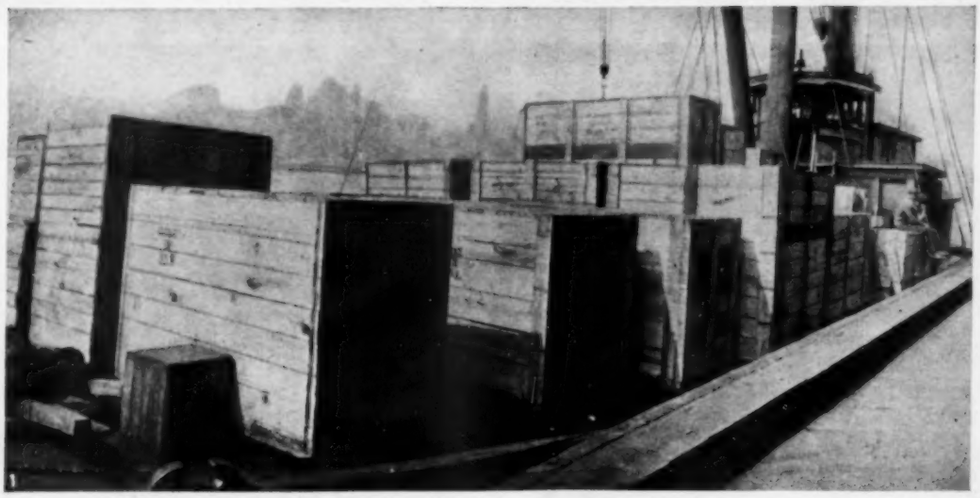
of the Disarmament Treaty

scrap purposes battleships and battle not yet been completed

5—After the superstructure has been removed.
6—Guns that have been sawed off by a cutting torch.
7—How a turret is cut up by means of a gas torch.
8—The ever-handy cutting torch makes short work of armor plate.







PACKING FOR EXPORT

WORTHINGTON PUMP & MACHINERY CORPORATION

1

Large cases are brought directly to the ships on the company's own lighter.

2

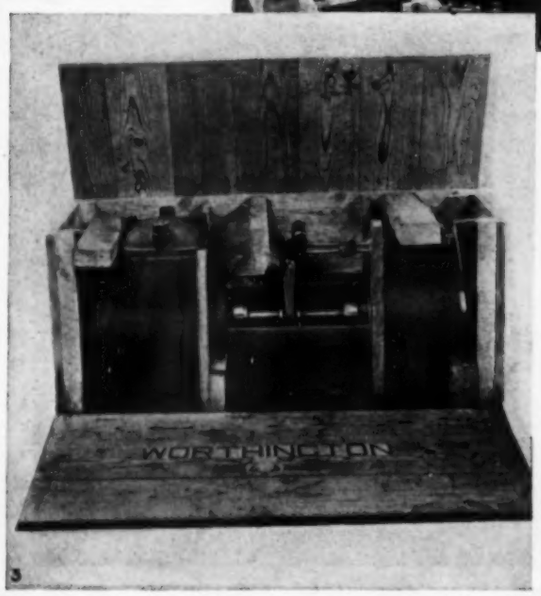
How the pumps are boxed in the Worthington Works at Harrison, N.J.

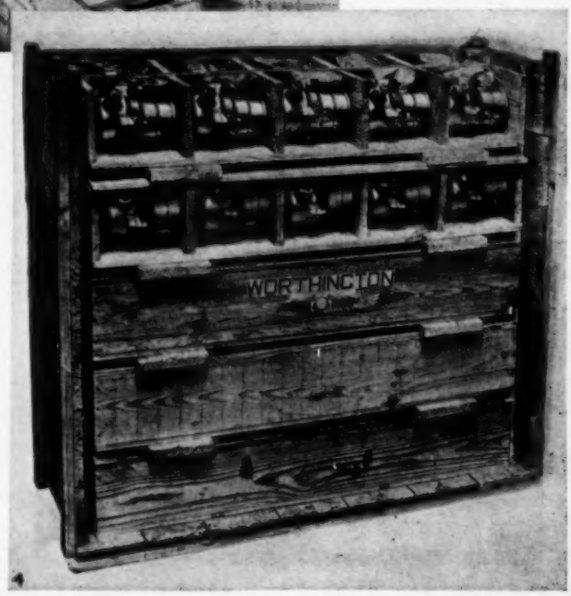
3

Note the bracing provided in the case to prevent strains on the pump.

4

Water meters receive particular care to insure safety.





Testing of Steel for Hardness

By H. M. GERMAN
Metallurgist, Henry Disston & Sons, Philadelphia

Instructions for using Brinell, Rockwell and scleroscope hardness testing machines — The service they render depends upon the judgment and care used in their operation and maintenance

DURING the discussion in the last symposium on hardness testing conducted by this society, the question was asked, "Would it not be possible to formulate some instructions as to how to use the different machines?" The machines under discussion were the Brinell, Rockwell and scleroscope. Acting upon the above suggestion, it was thought that a practical paper dealing with some of the most important factors and elements that introduce errors in the operation of these hardness-testing machines would be useful to the society.

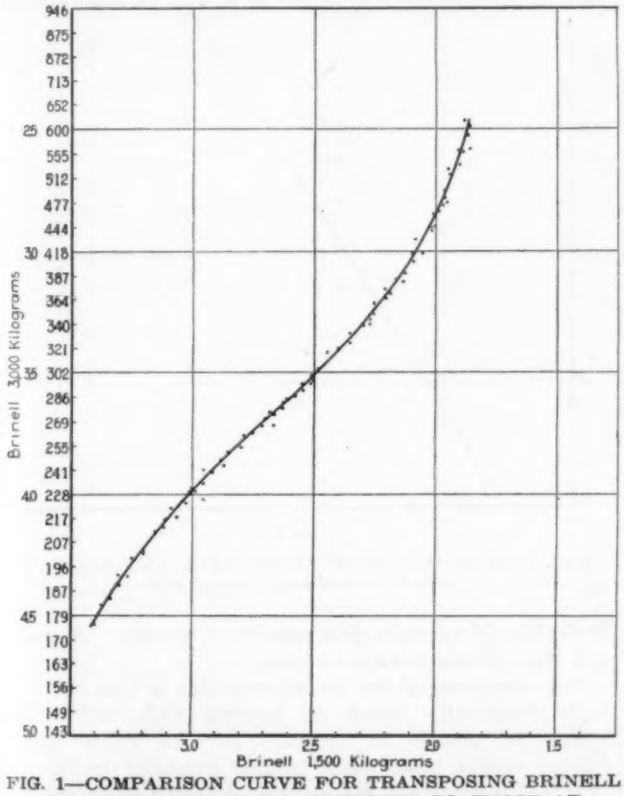


FIG. 1—COMPARISON CURVE FOR TRANSPOSING BRINELL READINGS AT 1,500 KG. PRESSURE TO THOSE AT 3,000 KG. PRESSURE, USING A 10MM. BALL

Brinell Hardness Testing

The Brinell test is a measure of hardness by deformation. In making a standard test a fixed pressure is applied on a hardened and polished steel ball 10 mm. in diameter which in turn penetrates the test piece that is held in a rigid position. The diameter of the impression is proportional to the resistance of the piece tested. For iron, steel and the harder metals 3,000 kg. is the standard pressure, while for the softer metals like lead and babbitt metal, a moderated pressure is used. To obtain the hardness number corresponding to the diameter of the impression, the diameter of the impression may be read with a microscope having a graduated millimeter scale or the depth of impression taken by a micrometer attachment. The readings obtained may be referred to a chart which will transpose them to the corresponding degree of hardness or hardness number.

Several plants use the diameter of impression as the unit of hardness, as for example 3.2 instead of the hardness number 364. This term conveys the same meaning of hardness and saves time in computing or comparing with a chart to obtain the hardness number. The practice of reporting Brinell hardness should be standardized.

The Brinell machine is still recognized as the leading standard for the engineer to compare different degrees of hardness on account of its accuracy and reliability when the necessary precautions are taken in making the tests. The Brinell machine has its limitations in that the standard test cannot be used for testing thin sections, those that will not stand a permanent deformation, or finished articles in which the depression mark would be objectionable. The standard pressure used for the test is 3,000 kg. and should be used whenever possible. However, by reducing the pressure the depth of depression will be decreased and thinner sections can be tested. If a series of test pieces having graduated degrees of hardness are prepared and readings taken with different pressures, it is not difficult to form a curve that will transpose readings at lower pressure to comparative readings at the standard pressure. There is given in Fig. 1 a comparison curve for transposing readings at 1,500 kg. pressure to those at 3,000 kg. pressure.

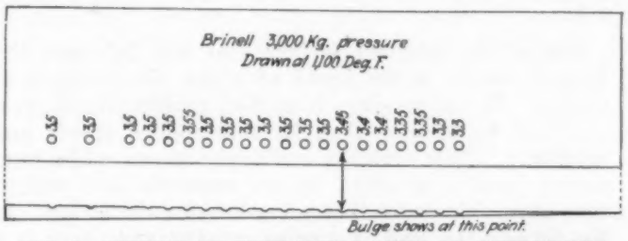


FIG. 2—SKETCH OF TEST PIECE USED TO DETERMINE GAGE LIMITATIONS

The gage limitation of specimens to be tested by the

Abstract of a paper presented at the Symposium on Hardness Testing, annual convention of the American Society for Steel Treating, Pittsburgh, October 8-12, 1923.

Brinell is also influenced by the hardness of the piece to be tested. For example, it is more possible to test a thinner section of high-tempered steel than of low-tempered steel as the impression will be much less in the former than in the latter. An impression which shows as a bulge on the opposite side will not give accurate results and should be discarded.

The minimum gage limits for Brinell and Rockwell tests on 1 per cent carbon steel hardened and tempered at different temperatures is shown in Table I. The results were obtained by hardening eight pieces of steel eight inches long by two inches wide by three-sixteenths of an inch thick, which had previously been ground to remove any presence of decarburization. The hardened pieces were then drawn at different degrees of heat and then taper ground and rough polished. A series of tests were then made on each piece at close intervals from the heaviest to the thinnest section and the point was noted at which the impression produced a bulge on the opposite side and the readings were influenced. The thickness at this point was measured with a micrometer and was taken as the minimum gage limitation for that particular hardness. In Fig. 2 the method used in determining the limitation is illustrated.

Table I

Minimum Gage Limits for Brinell and Rockwell Tests at Different Tempers

1.00 Per Cent Carbon Steel

No.	Drawing Temp. Deg. Fahr.	Brinell 3000 Kg. Pressure Reading	Brinell 3000 Kg. Pressure Gage Limit	Brinell 1500 Kg. Pressure Reading	Brinell 1500 Kg. Pressure Gage Limit	Rockwell Steel Ball Reading	Rockwell Steel Ball Gage Limit
1	700	2.7	0.050	2.2	0.030	114	0.023
2	800	2.9	0.060	2.25	0.035	113	0.024
3	900	3.1	0.065	2.4	0.040	111	0.026
4	1000	3.3	0.070	2.5	0.045	109	0.027
5	1100	3.5	0.080	2.6	0.050	107	0.029
6	1200	2.65	0.090	2.8	0.060	103	0.031
7	1300	4.0	0.105	3.0	0.070	94	0.034
8	Anneal	4.4	0.140	3.3	0.085	87	0.038

One of the greatest factors that will influence the Brinell results is the speed at which the pressure is applied. If the pressure is applied rapidly, the depression will be greater than if it is applied slowly and gradually. This error is strikingly shown when comparing results obtained by an eccentric and weight type of machine with that using a hydraulic action. In the former the load is applied quicker and there is a greater swing of the weight than in the latter. Average readings on these pieces of annealed steel are as follows:

	No. 1	No. 2	No. 3
Lever Brinell—fast pressure	4.4 mm.	4.6 mm.	4.3 mm.
Lever Brinell—slow pressure	4.3 mm.	4.5 mm.	4.2 mm.
Hydraulic Brinell—normal pressure	4.15 mm.	4.4 mm.	4.15 mm.

Part of the above difference may be due to the type of machine used.

The average difference between a fast and a slow application of pressure with the hydraulic machine is about 0.1 mm. in diameter for medium hard metals; the softer the metal, the greater will be the difference. A satisfactory period of time for applying the full load, is five seconds.

Another important factor that will influence the depth of indentation is the duration of time that the full pressure is applied in making the test. A short application of pressure will not give consistent readings as it requires time for the full pressure to exert itself in pressing the ball into the test piece and reach an equilibrium. This is clearly shown in the following test:

Period of Application Seconds	Brinell Readings				Average Reading
5	3.125	3.125	3.125	3.1	3.12
10	3.15	3.15	3.15	3.15	3.15
20	3.2	3.15	3.15	3.15	3.16
30	3.175	3.175	3.175	3.175	3.175
45	3.2	3.175	3.175	3.175	3.18
60	3.2	3.175	3 175	3.175	3.18

In this test the maximum reading was obtained at 45 seconds; there being no increase with an additional 15 seconds. In commercial testing the average duration is 10 seconds, but when more accurate readings are desirable, 30 seconds give consistent results. A standard time should always be used.

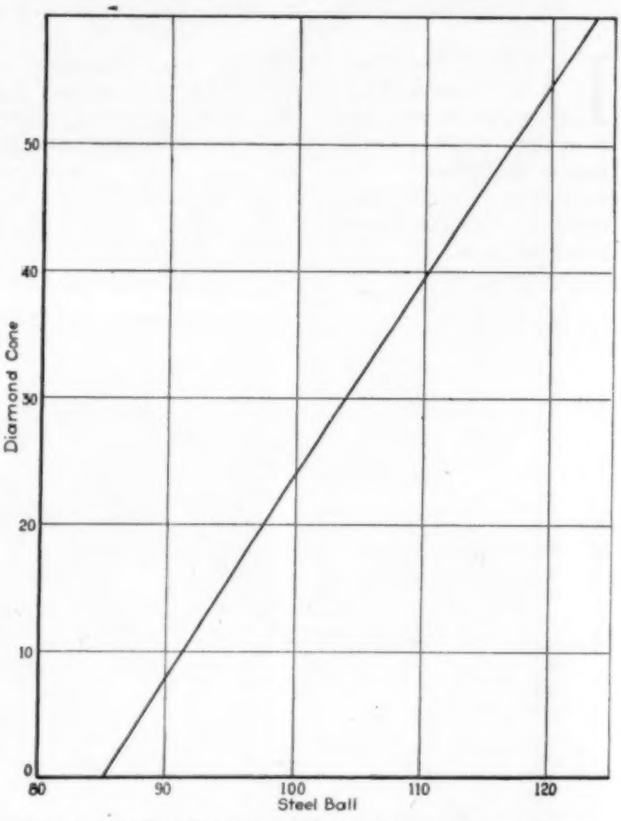


FIG. 3—COMPARISON OF STEEL BALL AND DIAMOND CONE ROCKWELL READINGS

One weakness of the Brinell machine is that the steel balls frequently crack or become deformed. This source of trouble is naturally greater when testing harder pieces than when testing annealed pieces. A cracked or deformed ball may be detected when reading the indentation as it will be out of round. Oval-shaped depressions should be discarded.

In order to obtain consistent readings, the following precautions should also be observed:

See that the surface of the test piece is at right angles to the direction of applied pressure and that it rests solid on the support.

See that the movable block on which the test piece rests is flat. The author has frequently seen blocks that had indentations made in them by the Brinell ball. This will give non-uniform results, particularly when testing thin sections. If the block is not flat, have it ground.

Check the reading glass frequently to see that the millimeter lines coincide with those of the standard. They occasionally get out of adjustment.

Check the instrument occasionally with a standard test block of known hardness. This should always be done when a new ball is used as they do not always seat propertly in the plunger.

Rockwell Hardness Testing

The Rockwell test is a modification of the Brinell. It consists of pressing a hardened steel ball ☆ in. in diameter or a diamond cone, of 120 deg. angle, into the piece to be tested and measuring the depth of depression with a dial micrometer. In order not to confuse readings, separate scales are provided for the ball and diamond depressions. The standard pressure

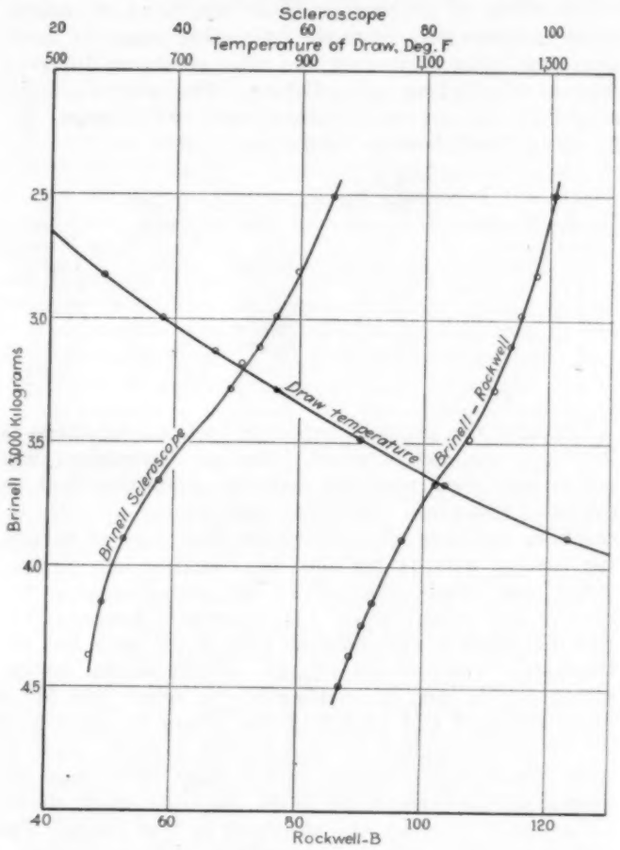


FIG. 4—BRINELL, ROCKWELL AND SCLEROSCOPE COMPARISON CURVES FOR A 1 PER CENT CARBON STEEL

applied for the maximum load is 150 kg. when using the diamond cone and 100 kg. when using the steel ball. The operating principle of the Rockwell machine is different from the Brinell in that the total depth of depression from the surface is not measured. In making a Rockwell test, a minor load of 10 kg., regulated by a spring, is first applied, the micrometer dial is set at zero, and then the major load is applied. Upon releasing the major load, the depth of depression caused by the major load only is indicated on the micrometer dial. This reading is taken as the degree of hardness. The Rockwell test has a special field in that it can be used for testing much thinner sections than the Brinell and it does not spoil the finish of the article tested, except on very highly polished work, but like the Brinell it has its limitation in that it cannot be used for testing thin sections that are brittle or those that cannot stand a permanent deformation.

For testing very hard articles such as hardened high-speed steel, milling cutters, etc., the diamond cone has a very useful field as it will not deform and give inaccurate readings. Steel balls give much trouble in testing high-tempered articles owing to their tendency to break and deform under pressure and, if used, should be tested against a standard specimen at frequent intervals. When testing annealed and low-tempered articles, the steel ball is preferred as it gives accurate results, it is less liable to break, and the scale has a wider range. Fig. 3 shows a comparison curve of steel ball and diamond cone Rockwell readings.

Since the Rockwell is an indentation test, the same factors that were discussed under Brinell testing, such as the rate of application of the major load and the length of time the load is applied, will influence the results. The rate of application can be varied by adjusting the strength of the major load spring. For accurate results, the time for applying the full load

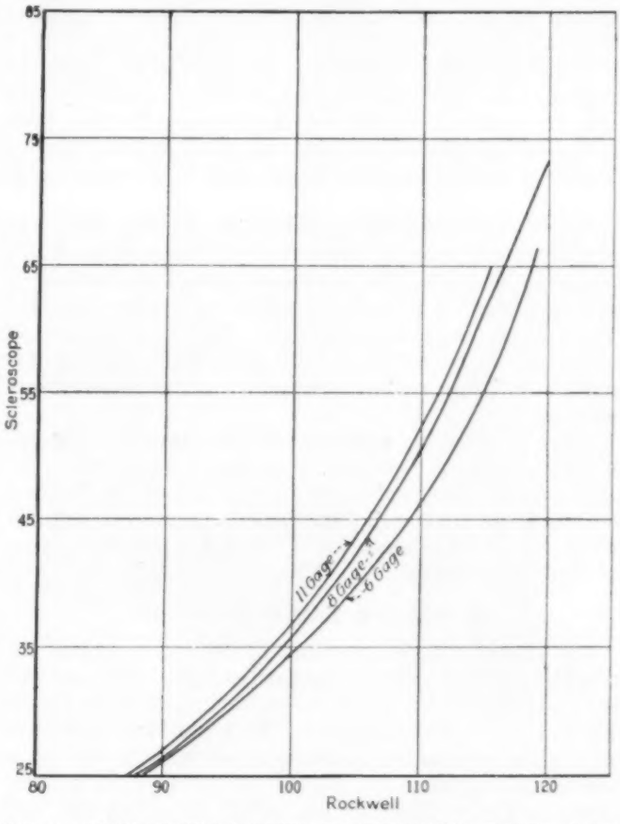


FIG. 5—COMPARISON CURVES OF ROCKWELL STEEL BALL AND SCLEROSCOPE TESTS OF FOUR DIFFERENT GAGES OF METAL

should not be less than five seconds, but if the test is made to roughly sort articles according to their hardness, the time may be lessened.

It must be clearly kept in mind that the Rockwell machine will test on a comparison basis. No factor or formula can be used that will convert hardness numbers obtained from one type of testing machine to that of another for articles of different compositions. If it is desired to convert Rockwell to Brinell or scleroscope terms, the best plan is to prepare a series of test pieces of the same gage and finish that range from hard to anneal in temper, take readings with the dif-

ferent testing machines and plot a curve that will show a direct comparison of the readings. In Fig. 4 is shown a comparison curve for straight carbon steel containing 1 per cent carbon, 7 gage.

Surface defects, such as scale or decarburized surface, do not affect the readings if they are not deep as the minor load overcomes their resistance, but if the thickness of scale or decarburized surface is excessive, the results will be misleading. If accurate readings of unknown samples are to be taken, it is a good plan to grind the surface before testing. Rockwell readings are not influenced by the smoothness or finish of the articles tested. You may confidently expect to obtain the same readings from polished articles that you get when testing them after they have been hardened and tempered. The results of a test made to show the influence of grinding and glazing on hardened and tempered pieces of 0.9 per cent carbon steel, 0.045 in. thick is as follows:

Readings were taken with a steel ball

Sample Number	Hardened and Tempered	Rough Ground (Wet Sandstone)	Rough Glazed No. 100 Emery)	Finish Glazed (Flour Emery)
1	116—117	116 —117	116 —117	116 —117
2	116—117	116 —117	116	116 —117
3	116	115 —116.5	115 —117	116 —117
4	115—117	116.5—117	115 —117	117
5	116—117	116 —117	116.5—117	117
6	115—117	116 —117	116 —117	115.5—117

Special care should be taken in testing that the specimens are properly supported and horizontal. When the piece is large, the overhang should be supported in such a manner that it will not be raised or depressed when the major load is applied. Improper support of the pieces to be tested and the use of improper anvils are two of the greatest sources of errors in Rockwell testing.

After changing penetrators or anvils, readings should always be taken on a standard test piece until uniform and standard results are obtained, as the first few readings are unreliable. This is because it requires pressure for the penetrator, anvil and chuck to seat themselves properly.

Scleroscope Hardness Testing

The scleroscope, as invented by Shore, measures the height of rebound of a standard weight when allowed to fall from a given height upon the article to be tested. When a very hard substance, like a hardened steel ball or a diamond-pointed hammer is allowed to fall on a horizontal surface, the height of rebound is proportional to the resilience of the article on which the hard substance falls. If the article to be tested is very hard, very little of the energy produced by the falling weight will be dissipated by indentation and the energy will be almost entirely expended on the rebound. However, if the article to be tested is quite soft, considerable of the falling energy will be consumed in indentation.

The falling weight of the scleroscope is a steel cylinder ¼ in. in diameter by ¾ in. long. It has a diamond striking point about 0.02 in. in diameter, which is slightly spherical and blunt in shape. This weight is allowed to fall by gravity from a height of 10 in. through a vertical glass tube on the article to be tested. The degree of hardness is measured by the highest point reached by the top of the weight on the rebound and is measured against a graduated scale in back of the glass tube. The scleroscope does not spoil the finish of the article to be tested, it can be used on very thin sections and by holding in the hand or supported on a movable arm is applicable for testing very large sections.

The scleroscope will give comparative results only when testing articles of like composition under like conditions. This point cannot be made too emphatic. By like conditions, we mean the same gage or thickness and the same surface conditions as rough, ground or polished. If a comparison test is made between Rockwell and scleroscope readings on a number of thin and heavy test pieces all having the same Rockwell degree of hardness, the thin pieces will give a higher scleroscopic reading than the heavy pieces. This is illustrated by comparison curves, Fig. 5, of Rockwell and scleroscope readings for different gages.

The effect of different surface conditions on scleroscope readings may be shown by testing pieces of hardened steel after tempering and after receiving different degrees of grinding and polishing. The results of such a test on 0.9 per cent carbon steel, 0.045 gage, are given in the following tabulation:

Sample Number	Hardened and Tempered	Rough Ground Coarse Wet Sandstone	Fine Ground Fine Wet Sandstone	Rough Polish No. 100 Emery	Fine Polish Flour Emery
1	67—69	68—70	74—75	75—78	78—81
2	69—71	73—75	75—78	75—77	79—81
3	68—70	74—78	75—78	78—82	79—81
4	68—70	73—76	76—79	78—80	79—81
5	69—71	74—76	75—78	77—81	79—81
6	68—70	73—75	76—78	78—81	78—81

Probably the greatest objection to the scleroscope is that the readings obtained from one instrument will not always check readings made by other machines on the same test piece. This has been proved not only by checking readings of instruments that were in service for several months but also by checking new instruments and those returned to the manufacturers for repairs and recalibration. It frequently happens that two instruments will check on part of the scale but not throughout their entire lengths. When several instruments are in use, it is desirable to select one for a plant standard and adjust all the others to agree with it. If an instrument is used to test a single class of work where the readings do not vary more than ten points, as for example 50 to 60, the instrument should be adjusted to check the standard in that range. The author has often felt that it would be quite an improvement in construction if the scale could be adjusted without removing the glass tube as adjustments could be easily and quickly made and the dangers of breaking and not reseating the tube properly would be eliminated.

As the hammer is permitted to fall freely, care should be exercised to keep friction between the hammer and the tube reduced to a minimum. This may be done by keeping the tube in a vertical position by means of the leveling screws and by frequently cleaning the inside of the tube and the hammer with chamois. When the scleroscope is used in a heat treating department or where the air is contaminated with smoke and oil fumes, the soot and oil adhere to the inside of the tube which causes friction and low readings. Also when the instrument is located in or near a chemical laboratory, the acid fumes will corrode the hammer. In replacing the top after cleaning, be sure that it is firmly seated in the proper position.

An Ingenious Device for Making a Peculiar Cam

By ELLSWORTH SHELDON
New England Editor, *American Machinist*

Cam-operated grinder table — A cam of peculiar shape — The problem of machining — An ingenious mechanical device — Result of machining is a number of small steps

THE reciprocating table movement of the Rivett internal grinding machine is unique in that it is derived from a cam instead of through the medium of rack and pinion or hydraulic cylinder usually applied to this class of machines. A peculiarity of the movement, made possible by the use of the cam (and to secure which was the prime objective in choosing the cam principle) is that the rate of travel is not uniform; the table moving at an appreciably accelerating speed as it approaches the point of reversal in either direction and slowing down as it recedes therefrom until mid-stroke is reached.

The advantage claimed by the makers for this peculiar movement is that it counteracts to some extent the tendency to grind holes "bell-mouthed"; and Mr. Rivett spent a great deal of time in experimenting with various rates of acceleration in order to determine just what the shape of his cam should be.

If the table of a grinding machine always moved through the same distance, regardless of the length of the piece of work the machine was grinding, a disk cam could be made to cause any movement, uniform or variable, that might be desired; but, unfortunately for his purpose, the range of table movement—length of stroke—must be variable at will of the operator from zero to the maximum capacity of the machine, and the change must be available instantly, without alteration or substitution of parts.

To make a cam that would provide the desired movement was easy. To make one that could be caused to change its range by a sweep of the operator's hand without at the same time altering any of its remaining characteristics was quite another matter. The object of this article is not to discuss the mental processes involved in the conception of the cam nor the tedious working out of mathematical formulas leading toward the embodiment of the conception, but to describe an ingenious mechanism applied to the making of the original cam and still employed by the Rivett Lathe & Grinder Corporation, the successor of Mr. Rivett, to duplicate it in quantities.

First, a description of the cam itself is necessary. The illustration, Fig. 1, shows three views, or rather a view of three identical cams; the one at *A* being finished and ready to take its place in a machine, another at *B* that has been machined but not ground (polished) and a third at *C* which displays the contour.

The cam is the frustrum of an irregular cone. It changes its mean diameter uniformly from end to end, but the relation of its various radii does not change. In other words the cam, while changing constantly in *size*, is of exactly the same *shape* at one end as at the other, or at any plane between. When assembled into a grinding machine the axis of the cam is either horizontal or vertical, according to the size of the machine, and it revolves about this axis, being driven by means of bevel gears at any desired rate of rotation.

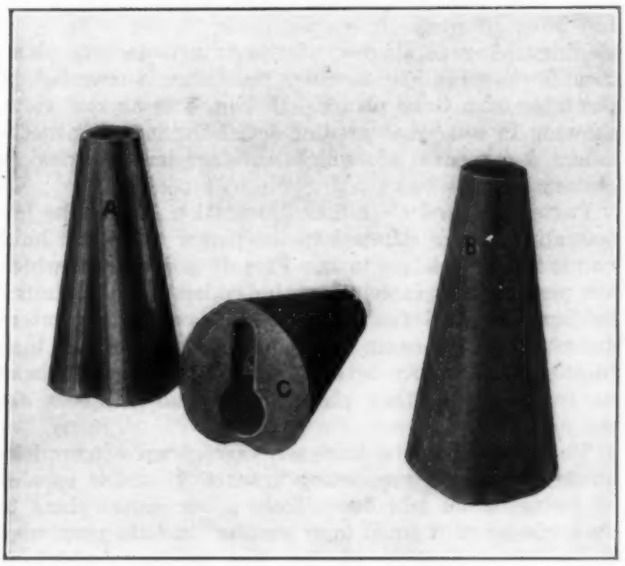


FIG. 1—CAMS FOR RIVETT GRINDING MACHINE

The roller through which the movement is transmitted to the table of the machine is parallel, about an inch long, and is mounted in a swiveling bracket that permits it to seat firmly against the cam and present a full line contact regardless of the position it may occupy. The swiveling bracket is gibbed to the face of a lever of the first class that swings in the same plane in which the axis of the cam lies. The bracket may be moved along the face of the lever, to or from the fulcrum, a distance equal to the length of the cam; the movement being under control of the operator through a handwheel located at the operating position, and is the adjustment for length of table stroke. The roller is held always in contact with the cam by means of springs attached to the upper end of the lever.

A round-bottomed groove having a radius equal to the radius of the roller extends over the full length of the cam parallel to the axis thereof. It ceases, however, to be a groove as it approaches the small end, for at that point the bottom line of the groove coincides with the periphery of the cam and the groove, as such, has disappeared.

The cams are of cast-iron, and are machined by

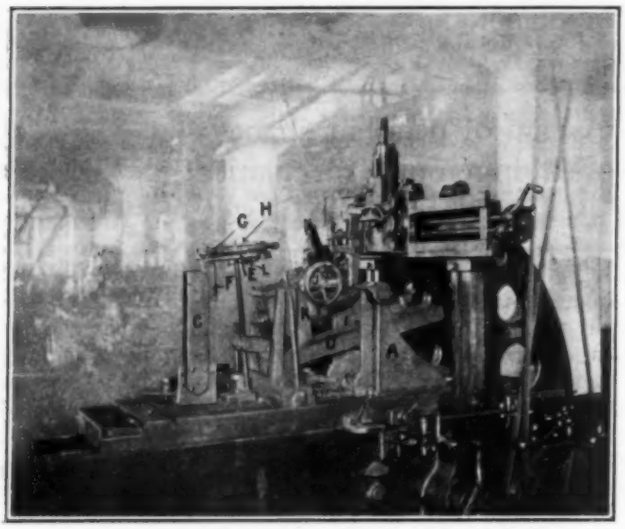


FIG. 2—FIXTURE FOR PLANING THE CAMS

planing. A general view of the fixture used to plane them is shown in Fig. 2, where the device is mounted on the table of a Gray planer. In Fig. 3 is an end view, showing in somewhat greater detail the indexing mechanism by means of which the accelerated rise is obtained.

Parts *A*, *B* and *C* (either illustration, where the letters appear) are clamped to the planer table and have no movement relative to it. Part *D* is a base to which are permanently fastened an index head and footstock having the usual functions of standard index centers except that they cannot be moved endwise of the base to alter the distance between centers, nor can the head be swiveled in either plane. These adjustments are not needed.

The entire base is, however, carried upon trunnions at the top of the supporting bracket *A*, and is capable of swinging up and down from a horizontal plane to an angle below it equal to or greater than the maximum angle of inclination of the cam surface; which is diametrically opposite to the groove before mentioned.

The casting *B* is a yoke, machined upon its inner faces to confine the tilting unit (the base, head- and footstock) against sidewise movement, but is not fastened to it. The sole duty of part *C* is to locate the large index plate *E* circumferentially; allowing it to rotate when necessary by swinging the latch *F* out of engagement, or locking it, always in the same position, at other times.

The long screw, on the upper end of which the index plate *E*, ratchet wheel *G* and pawl lever *H* are carried, has a ball-shaped thrust bearing at its lower end and passes through a swiveling nut attached to the end of the tilting unit *D*, so that movement of the latter is effected by turning the screw.

A cam may be seen at *I* in the fixture, ready to be cut. The casting is made very close to finish size and shape so that the planer tool has but little material to remove. A point to be remembered is that the apex of the conical-shaped cam when in the fixture coincides exactly with the intersection of the line of centers upon which it is mounted with the center line of the trunnions about which the tilting unit swings.

When first mounted in the fixture the cam lies with the groove uppermost and the base of the tilting unit (and consequently its line of centers) is horizontal, in which position the round-nosed planer tool is fed down (with the planer running) until the groove has been machined to finish depth. Having reached this depth, which is determined by a size block placed on the arbor under the tool point, the tool is in correct radial position and is not disturbed thereafter.

The planer table is run back and stopped, the latch *F* lifted out of engagement with its locating bracket *C*, and the screw rapidly rotated by hand until the tilting unit has reached its maximum angle of inclination; a position determined approximately by a witness mark of the casting *B* and exactly by the latch *F* again engaging with its locating bracket.

The cam is then rotated through one-half turn by means of the handwheel *J*, at which time, by reason of the inclined position of the centers, the "high point" of the cam is parallel with the planer table. The planer is started and the tool cuts along the high point of the cam. Handwheel *J* is keyed to the worm shaft of the index head and the small index plate *K* is also keyed to the same shaft so that the (rotative) angular advance of the cam may be gaged with certainty.

The ratchet wheel *G* is keyed to the elevating screw.

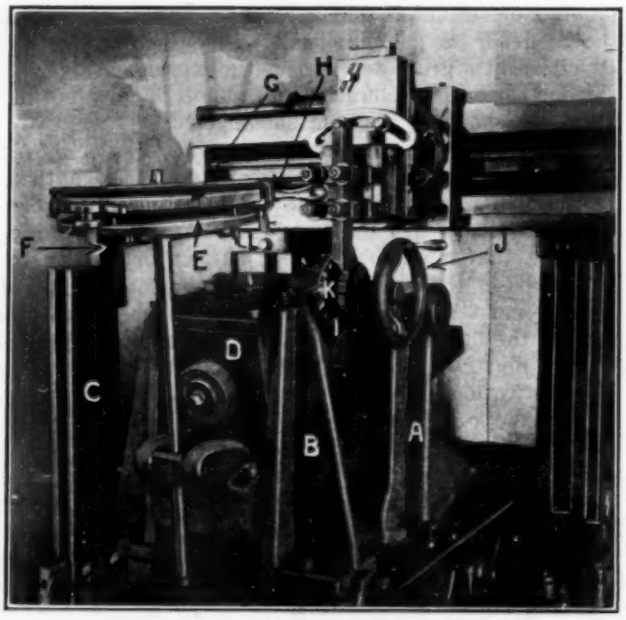


FIG. 3—DETAIL OF THE INDEXING MECHANISM

The pawl lever *H* turns freely upon the upper end of the screw and carries pawls to engage with the ratchet. The amplitude of movement of the pawl lever is limited in one direction by a fixed stop on the index plate *E* and in the other direction by the knurled-head stop pin *L*, which fits any one of various holes in the same index plate.

The machining is started at the high point of the cam. After the tool has passed once over the cam (one stroke of the planer table) and while the table is

running back, the operator turns the handwheel *J* forward one notch of the small index plate *K* and at the same time with his left hand moves the pawl lever *H* through one complete cycle, forward and back to the respective limits in each direction. This combined movement has rotated the cam through a definite (though very slight) angular advance, and at the same time has lifted the large end of the cam toward the cutting tool so that the latter on its second pass will take a slightly deeper cut. The small end of the cam has, of course, been lifted also, but the amount is proportionately smaller because of the closer proximity to the trunnions—the center of swing.

The double movement is made by the operator at each return stroke of the planer table until the tool has made ten cuts over the length of the cam. Between the tenth and eleventh stroke he not only makes the same movements but at the same time shifts the stop pin *L* to another hole in the index plate so that the pawls of lever *G* pick up two less teeth of the ratchet than before.

After ten more strokes of the table the pin is again shifted and again the range of movement of the ratchet has decreased by two teeth. These movements are continued (at no time is the planer stopped) until the cam has been rotated 180 deg. and the tool is again in the groove. So carefully has this differential movement been calculated that the tool drags over but does not cut the bottom of the groove. The latch *F* is then disengaged, the tilting unit lowered to starting position, and the entire cycle repeated with the cam rotating in the opposite direction to allow the remaining side to be finished.

The variation of two teeth of the ratchet to ten strokes of the planer table has been selected merely for the purpose of illustration. The actual variation may be somewhat different at different points as the acceleration curve requires. The operator has nothing to do with it, as it has all been worked out by the designer who located the holes in the index plate. The operator has only to count the strokes and shift the pin progressively at the required time.

The actual acceleration (more properly "deceleration," as we are working backward) is, of course, in the form of minute steps instead of a true curve, but as there are some hundreds of teeth in the ratchet and the elevating screw is of comparatively fine pitch the machined cam presents the appearance of a smoothly planed surface. The cams are surface hardened, and polished perfectlty smooth in succeeding operations.

Who's Boss?

By George Walter

WHO'S boss? I believe that this is one of the most frequent and annoying questions a man engaged in maintenance work has to contend with. It is not a pleasant one at times either.

Present day maintenance takes in a large field and the cut and dried systems used in the shop at large are hard to apply. Putting it as our factory manager did the other day, "Your job, all in all, seems to be doing the work about the shop which no one else appears to think they should do."

When no one seems to know just why this or that is thus and so about the place, they run for the man who has charge of the shop maintenance. The general manager driving in in his car in the morning notices something unsightly in the yard. Before he reaches his office the chances are that he will spy the millwright, or somebody else of the maintenance gang, and want to know why it is there and when it will be removed. Before the man has a chance to explain that he has been busy on some job, or that he is doing something at the express order of some superior, the G.M. is gone.

Then the superintendent comes along with another job and the order to "let nothing interfere with its being done." Before this work can be even started something goes wrong up in the shop and the production manager comes raring to have it fixed right away. Next the lathe foreman wants to know when he can get an emery wheel dressed. The tool room boss wants a surface plate leveled and a couple of work benches moved. The chief draftsman wants a better light, or the windows whitewashed. The office clerk wants a typewriter desk fixed up. The assembly room wants some bins made for spare parts. The tool crib keeper wants a rack made for a set of newly arrived tools.

In the small shop where two or three men take care of all the maintenance work, this condition becomes exasperating. The maintenance foreman finds himself at noon with nothing accomplished and jobs enough piled up to last him a month, and what is to be done?

The job of maintaining the shop in good running order is turned over to the maintenance man and he is supposed to do it in his own way. His job is to figure out the way to do things to the best advantage, and here the elements of time required for the job and its importance are governing factors. He can see how this or that should be done, but can he make those above see it?

The new foreman comes on the job and is introduced. "Do anything he asks within reason," says the superintendent. About the next thing that follows is that the new foreman throws a fit because the millwright does not leave a countershaft suspended halfway between the roof and the floor, long enough to see what's the matter with a clutch pulley that won't pull. The millwright's job is of such a nature that he is apt to have ragged nerves, and the foreman may get it as hot as he sends. Then, under the impression that such jobs were to be done for him without question, he goes to the office to find out why he can't have things his own way.

Presently the G.M. comes back from lunch and finds that unsightly something still in the yard. The chief draftsman makes an error and starts raving about the poor light. In the assembly room an apron cannot be completed because some of the parts are missing. Two reamers out of the new set of tools in the tool crib have been ruined because they rolled off a bench upon the concrete floor. Production has been held up because of a bad countershaft. A lift truck has been broken down and a man injured because it wasn't repaired when reported in bad order by the safety inspector.

About 2 P.M. explanations begin and at 5:30 a check-up shows about two hours work really done out of the ten. Of course there are days when it is plain to see that the maintenance gang is stalling or "putting in time," but who ever saw maintenance work when it didn't come in bunches, and the bigger the bunch the more one wonders—"Who's Boss?"

Ideas from Practical Men

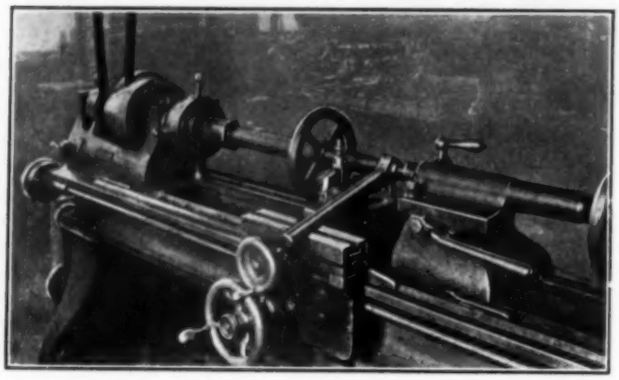
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

An Ancient but Effective Boring Rig

BY JOHN WILLIAMS

A boring rig that has been in service for seventy years is shown in the accompanying illustration. It was not always used in connection with the lathe in which it is here shown, for that is a more recent product, but it can be used in any lathe as it is supported only by the centers.

The casting with the projecting set screws is a chuck, and is screwed on the spindle nose of the lathe. This chuck was made specially for the job of holding the



AN OLD BORING RIG IN A MODERN LATHE

collars, one of which is shown in place, for boring, but will, of course hold any piece within its capacity. It is not a necessary part of the boring outfit, for the latter can be used with any chuck or upon work that is "swung up" on a faceplate.

The basis of the boring rig is a bar, centered at both ends and having two longitudinal feathers, or keys, set 180 deg. apart, over about one-half its length, while the remainder is cut with a substantial square thread. One end of the bar is squared and a solid-end wrench is provided, the handle of which rests upon one of the wings of the carriage to prevent the bar from turning.

The bits, or actual boring heads, of which the shop has a wide variety of sizes that have accumulated over a long period of years, are splined to fit over the keys of the bar, on which they slide freely. The long bushing with the handwheel on the end is threaded to fit the square threads of the bar. The bits are made of mild steel and have four equidistantly-spaced dovetail slots cut lengthwise of their outer surfaces to take the cutting tools.

The dovetail slots are not quite parallel (radially) with the axes of the bits, but are inclined slightly toward the outer, or cutting, end so that radial clearance is provided for the tools, and also to allow the latter to be set outward (lengthwise) in order to preserve the diameter of the bit as the ends of the tools are ground away. There are no backstops for the tools; they are a tight drive fit in the dovetail slots and the friction is depended upon to keep them from being pushed back by the pressure of the cut.

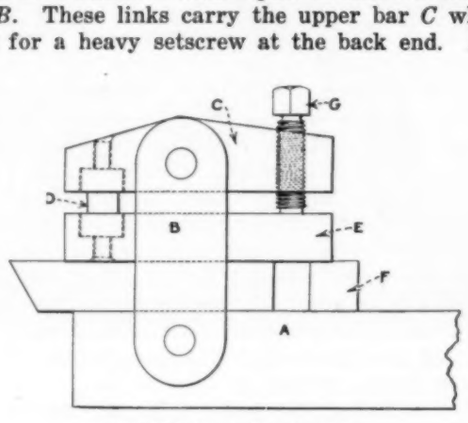
To use the rig the work is centered in a chuck or swung up on a faceplate as the case may be, and the bar, with a bit in place, is put between the centers with the wrench on the squared end resting upon the wing of the carriage (sometimes, I regret to say, upon the shears of the lathe, where it has no business to rest). Turning the handwheel causes the long bushing to push the bit through the work. To change the bit for one of larger size in case it is necessary to make two or more cuts it is necessary only to take the bar off the centers and make the exchange; an operation that can be done with one hand while holding the rig in the other.

Considering the antiquity of the tool it is capable of removing stock with astonishing rapidity. Indeed, no modern tool could be more capable within its limitation as to size. On its regular work it is expected to be followed by a hand reamer, but it can be accurately (though not handily) adjusted for finished sizes by means of a micrometer and dial gage; tools that were undreamed of when this rig was made.

A Toggle Tool Holder

BY CLIFFORD H. FRENCH

Here is a tool holder I saw in the land of million dollar salaries and motion pictures, in the shop of the Cinema Machine Co., Hollywood, Cal., to be exact. It consists of a shank *A* with a pair of links on each side as at *B*. These links carry the upper bar *C* which is tapped for a heavy setscrew at the back end. At the



A TOGGLE TOOL HOLDER

front a sort of loose, wabble attachment *D*, holds *C* to *E*, but allows freedom of movement between them.

By using a small block of steel of the same size as the tool itself at *F*, and tightening the setscrew *G*, the tool is held very uniformly and firmly along its whole length. Although the arrangement looks a bit high or topheavy, it has worked out very well and holds tools with no danger of slipping under any cut.

Two-Tool Attachment for Single-Head Planer

By B. R. Wicks

The two-tool planing attachment shown in the accompanying drawings was designed for the purpose of saving time in the planing of a lot of machine-steel plates 15 in. square by ½ in. thick, which required two cuts over each side, reducing them to a thickness

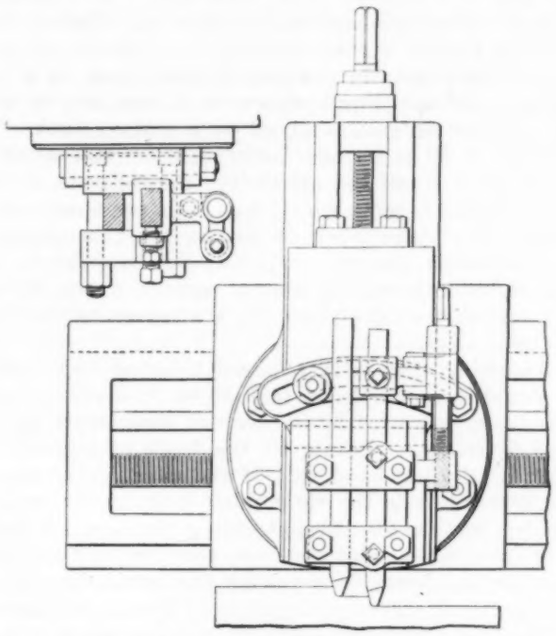


FIG. 1—ASSEMBLY OF THE TWO-TOOL PLANING DEVICE

of ⅜ in. within a tolerance of 0.005 in. With this device the actual passage of two cuts over a side required but very little more time than would have been needed for a single pass.

Six plates were ganged at a time and held by heel and toe dogs. The leading tool was started with a sufficient depth of cut to take off half the stock, less

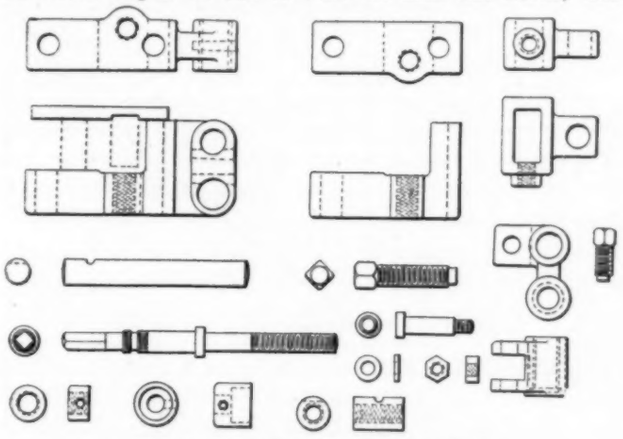


FIG. 2—DETAILS OF THE DEVICE

0.010 in.; which amount was left for the finishing tool immediately following. The wear on the point of the roughing tool in making the cut over a gang of six plates was less than 0.015 in. and the finishing tool showed no perceptible wear.

There were 150 of the plates to be planed, and the work was done in about one-third of the time that would have been required by the ordinary method, for the reason that not only was a large part of the cutting time saved, but two extra set-ups were also eliminated. The plates were finished within the required limits as to thickness and with results as good as could have been obtained by the usual two operations per side.

The drawing, Fig. 1, shows the assembled device and indicates the manner of using it. Fig. 2 shows the details. There are but twelve parts to be made, including the two tool-holding straps to be substituted for those already on the planer. Two O. K. toolholders fitted with high-speed steel bits were used. The first, or roughing, tool is held by the straps in the usual way and is adjusted for depth of cut by the regular down feed. The finishing tool has an independent adjustment by means of the micrometer screw, working in the nut that is a part of the upper tool-holding strap and governing the position of the tool by the double-swivel yoke through which the tool shank passes. A setscrew in the lower tool strap serves to tighten and hold the finishing tool in position after the adjustment for depth has been made.

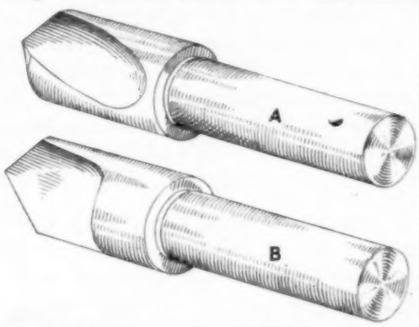
The device may be removed from the planer in a few minutes, leaving the latter in condition to be used in the regular way with a single tool, as the application of this device does not require the alteration of any of the original parts.

Two Handy Centering Drills

By J. A. Davis

Wembley, England

The sketch herewith shows two very handy forms of centering drills to have around an engine lathe. The one at *A* is used for centering machine and tool steel.



TWO FORMS OF CENTERING DRILLS

It is made from a ⅜-in. high-speed steel twist-drill that had been worn down until it was no longer of service for its original purpose. The shank was found to be quite soft enough to be turned without resorting to the annealing process.

The drill at *B* is used to center cast iron, brass, phosphor bronze, etc., and is made from a piece of ⅜-in. round tool steel. It is made much like a flat drill and is very short and rigid.

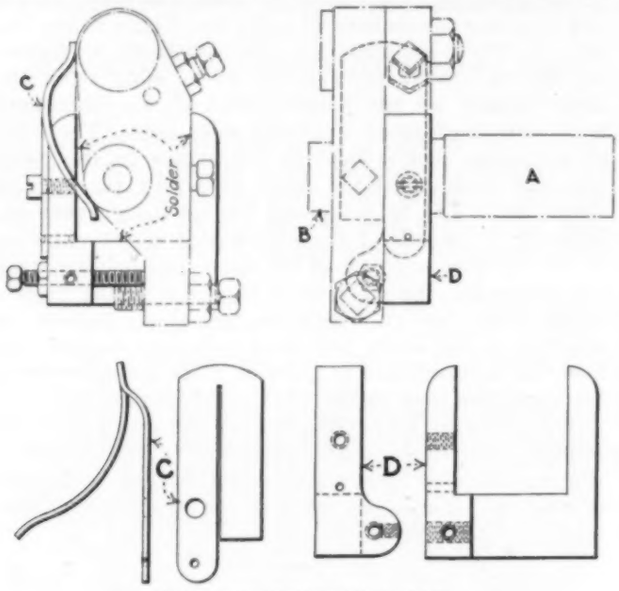
The included angle of the cutting edges of each of the two drills is made slightly less than 118 deg. so that ordinary twist drills, ground to the standard angle, will start true. A point to be watched in case the hole to be drilled is larger than ⅜-in. (the diameter of the centering drills) is that the metal around the countersink made by the centering drill is faced true.

By using these drills to start a hole, little trouble will be experienced in drilling true holes unless, of course, on cast iron we should encounter blow holes. In such case it is sometimes necessary to steady the end of the drill by means of a tool held in the toolpost with the blank end of the tool against the drill.

A Special Recessing Tool

BY EDWARD LARUE

The accompanying illustration shows a modification of a No. 0 Brown & Sharpe standard recessing tool, used for an operation on the main wheel of a watch. As the wheel is somewhat larger than the work for which the



MODIFIED RECESSING TOOL

tool was primarily intended the tool has been modified by the addition of two parts and by giving it a greater range of spring action by means of a coil spring in part *A* to act against a pin in part *B* of the tool.

The two main parts added to the standard arrangement are here noted as parts *C* and *D*, and are shown in detail. Part *C* is made of spring steel, hardened and tempered, held in place by a fillister head screw and dowel. Part *D* is of machine-steel, pack-hardened, and is soldered to the body of the tool on three surfaces.

The action of the device will readily be observed. It has been in operation for a considerable time and has proved very satisfactory.

Chart for Showing the Amount of Liquid in a Horizontal Tank

BY J. P. DOOLAN

Superintendent of Maintenance, Morgan Engineering Co., Alliance, Ohio

The writer has been called upon on different occasions to furnish a chart showing the quantity of liquid at various depths in cylindrical tanks lying in a horizontal position. For instance, it is required to know the number of gallons of oil in a storage tank. The amount of oil is usually ascertained by measuring its depth in the tank and calculating the contents, or finding it from a table which has been previously calculated. The calculation, of course, must be made for each different diameter of tank; but in order to give the same information, closely approximated, without the need of the calculation, the accompanying chart was devised.

Assuming that it is required to know the quantity of liquid in a cylindrical tank 80 in. in diameter, when the liquid measures 30 in. deep at the center, we proceed as follows: Locate 30, the depth of liquid in the tank, at the left-hand side of the chart, following the horizontal line to the right until it intersects with the vertical line for 80, the diameter of the tank. Through this intersection and the zero point at the left draw the line as shown, intersecting the percentage axis at 37.5 per cent. From this point, by moving horizontally to the right, the curve will be intersected at a point indicating slightly over 34 per cent of the total capacity of the tank.

It can readily be seen that the actual quantity of liquid in any tank, the capacity of which is known, can be quickly determined with the minimum of calculation, after the depth of the liquid has been ascertained, measuring it to the lowest part of the tank.

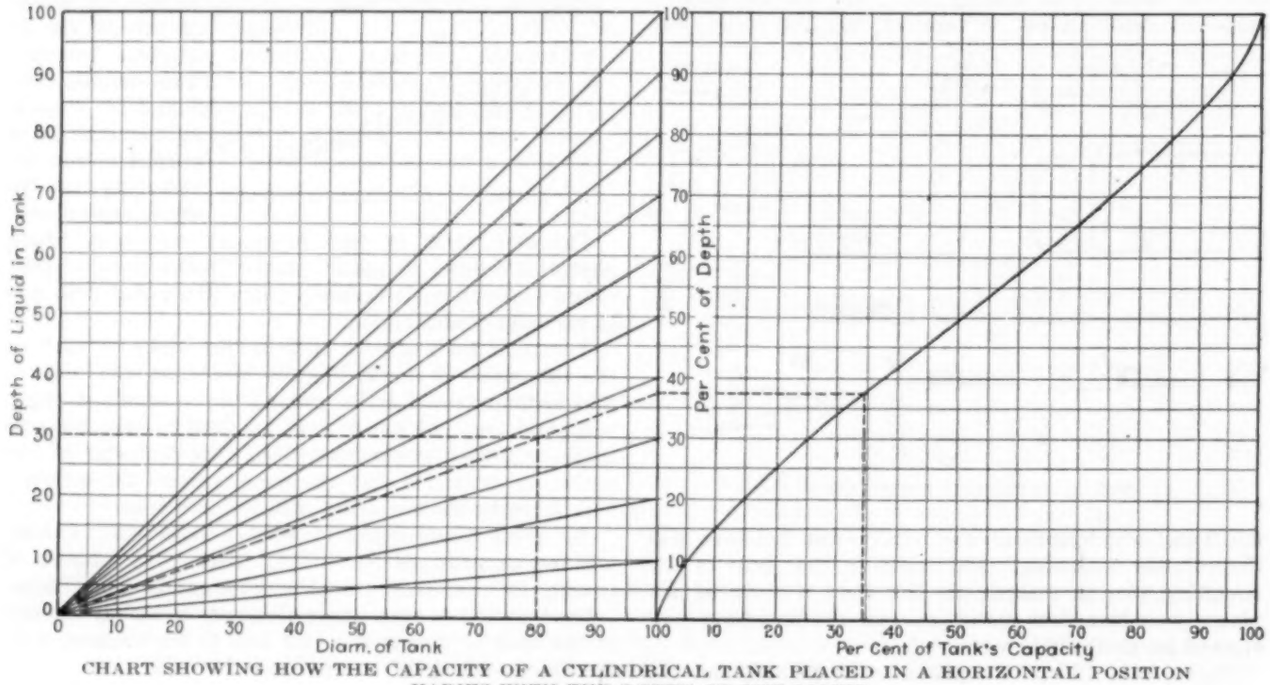


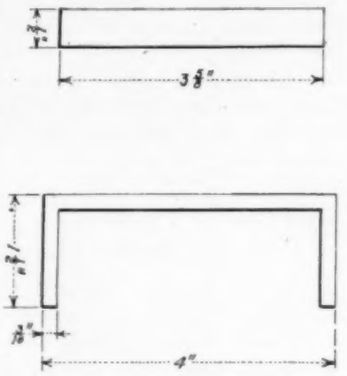
CHART SHOWING HOW THE CAPACITY OF A CYLINDRICAL TANK PLACED IN A HORIZONTAL POSITION VARIES WITH THE DEPTH OF THE LIQUID

Strength of an Automobile Frame Patch

By Donald Hampson

Repair shop machinists are sometimes called on to patch automobile side frames which have cracked. The most natural way to do that sort of work now is to weld the broken channel. This makes a very good job because there is no objection to building up additional metal at the critical point where different grades of steel, together with a possible lack of fusion at the weld, make the frame apt to crack again under the shocks of road work.

There are many isolated sections where welding equipment is not available and there are customers who prefer a mechanical repair to a weld, so that the patch still has a place in repair work. It can be made a first class job too, as proven by the hundreds of cars that were repaired in that way long before welding became so common.



PATCH FOR 4-IN. FRAME

I remember such a repair in the case of an old Knox car. A plate of ⅜-in. steel was put inside the frame, extending 12 in. each side of the break, fitted snugly between the flanges and then hot riveted. The owner thought it a good job but preferred a better one. So he drove the car to the factory where they stripped it and put a new channel (of the same ¼ steel) inside the broken one for the full length of the car. The new channel was spot welded in places and the various fittings and cross members riveted on, and the break in the outside channel was welded tight. Two months later, the job cracked through both channels in the same spot. Again an inside patch was applied and this time the owner left it alone. That car is running yet and the frame is as straight as when it left the factory. When making such a repair the question arises as to the relative strength of the parts. Take for example the 4-in. frame of ⅜-in. steel shown and compare its strength with a patch made from a piece of half-inch flat steel. The strength value of each is the section modulus of the section.

For the channel

$$S = \frac{1\frac{1}{2} \times 4^3 - 3\frac{3}{8}^3 \ (1\frac{1}{2} - \frac{3}{8})}{6 \times 4} = 1.4$$

For the plate

$$S = \frac{\frac{1}{2} \times 3\frac{3}{8}^2}{6} = 1.09$$

From the above it may be seen that the original pressed steel frame is stronger than the ½-in. patch. Assuming that both are of equal unit strength, the patch should be made out of heavier stock, preferably ⅝ in. in thickness. It has been assumed that the channel was made with sharp corners and not with rounds as is the actual case—this would give the channel strength a slight excess on paper.

Where it is possible to get in such an inside patch without disturbing cross members, it is the simplest method of mechanical repairs. It may be cut from a steel flat and is easy to fit very close to the flange rounds, or to such a contour as the gooseneck if the break occurs at this point. By fitting thus closely, part of the bearing is taken off the rivets which tends to keep them tighter in daily service. A channel shaped piece fitted over the outside is of course stronger yet but it is rather difficult to shape up.

Gages for Setting Thread Tools

By Otto E. Seiffert

Parts with internal and external threads of correct angle, diameter and pitch will fit together properly, while in parts with threads of incorrect angle, as shown

FIGS. 1, 2 AND 3—INCORRECT ANGLES OF THREADS

in Figs. 1, 2 and 3, the threads must either be cut deeper or have their width decreased to enable the parts to be properly assembled.

Gages for setting thread tools, as shown in Figs. 4 and 5 have proved very useful and, if properly used, will result in the cutting of threads having correct angles.

The bottom part of the gage shown in Fig. 4 is used for setting the tools for cutting external threads. The upper side can be placed against the work or, if the work is shorter than the gage, the gage can be held between the lathe centers while setting the tool. The

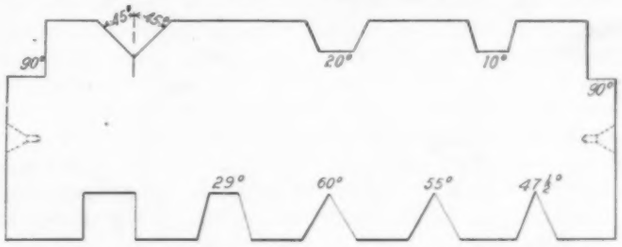


FIG. 4—TOOL-SETTING GAGE FOR EXTERNAL THREADS

upper side of the gage can be provided with notches having any convenient angles.

For cutting internal threads, a gage such as shown in Fig. 5 is very convenient. In setting the tool, the end *A* can be placed against any plane surface of the work, or against the faceplate of the lathe. If more

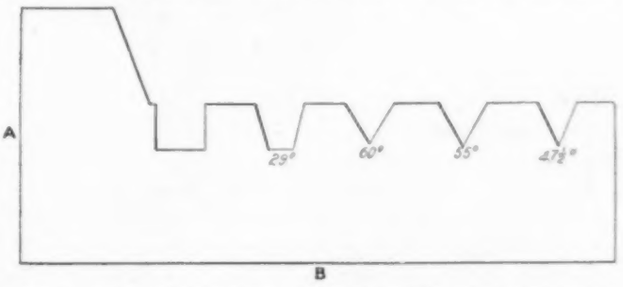


FIG. 5—TOOL-SETTING GAGE FOR INTERNAL THREADS

convenient, the side *B* can be placed against the wall of the hole to be threaded. This gage can also be used for setting the tools for cutting external threads, by placing the side *B* against the work or the tailstock spindle of the lathe.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

November 22, 1923

Tax Reduction or Bonus?

SECRETARY Mellon's clear and comprehensive letter on the possibility of tax reduction next year contained cheering news for industry. Everybody has been acutely conscious, in the region of the pocketbook, of the cost of carrying on modern warfare, but many of those who should feel the burden of the income tax the most severely have been able to evade it with perfect legality by transferring their investments to tax-free securities. As a consequence the money that formerly went to industry to provide for expansion and normal growth has been missing and has caused universal curtailment of business.

The suggestion of the Secretary that three hundred millions be lifted from the tax load has been welcomed by industrial leaders everywhere as one of the best things that could possibly happen to American business. The only thing better would be the complete settlement of all of Europe's various problems.

But—and it's a very large but—there can be no hope of tax reduction if Congress insists on passing a bonus bill, as it seems likely to do. On the contrary, taxes of some kind would probably be heavier over a period of years. If the bonus were used to help the disabled veterans of the war no possible objection could be raised to its early authorization but it would do nothing of the sort. We cannot rid ourselves of the conviction that the bonus legislation proposed at the present time is purely political, if anything political can be connected with the word "pure."

As a political measure the bonus bill seems to us to be indefensible. We have mentioned its effect on industry. But if industry is further handicapped the consequences will react to the disadvantage of every one connected with it in any way, and that means the great majority of the people in the United States.

If Mr. Mellon has done nothing else he has at least clarified the issue. Bonus or tax reduction, which do we want? And are we sufficiently concerned to instruct our representatives in Congress? Let's hope so.

How Conveyors Cut Costs

THE use of conveyors for handling work between machines or in assembling has more phases than appear at first glance. Introduced primarily to save labor handling, its use discloses a number of other advantages. In the case of the power driven conveyor, the psychological urge of a constantly moving belt or chain, automatically and unconsciously speeds up the movements of the worker to a certain point. Beyond this it seems to fail and to hinder rather than help production.

There is, however, another and very important effect of introducing conveyors, of either the power or gravity type. The saving in the capital tied up in parts in process is so great in some cases as to be almost unbelievable. This saving as pointed out so forcibly by H. P. Harrison of the Franklin Motor Car Co., in his recent paper before the Society of Automotive Engineers, is always considerable, and in some cases cited, runs up well over seventy-five per cent. The capital so released will be of material help in installing a conveyor system.

It must not be supposed, however, that any old conveyor system will give the desired results. The situation must be carefully studied and the system selected which will give best results for each particular place. Some departments or operations may require gravity and others power driven conveyors. Mr. Harrison has been frank enough to point out his own mistakes and their remedies. Few of us have the courage to admit our mistakes but they are frequently as valuable as successes.

One Out of Twelve on the Public Payroll

FIGURES published not long ago by the National Industrial Conference Board tell us that one out of every twelve persons over sixteen years old and gainfully employed in the United States is on the public payroll. They also indicate that the total salaries of public servants amount to nearly four billion dollars annually which works out to thirty-four dollars apiece as the cost to each man, woman and child in the country.

Things are certainly getting more and more complicated in this hurrying civilization of ours and among them is government. The question is whether or not we ought to spend so much to govern ourselves. In a modern factory overhead is not allowed to rise unless total unit costs are lowered to an even greater extent. In other words, additional management complications are only justified if they more than pay their way.

Is this the case with government complications and overhead or are we just getting a little nearer to the state of taking in each other's washing?

Two Hundred and Sixty-Six Miles an Hour

PERHAPS by the time this issue is in your hands some one will have exceeded the speed mentioned in our title, but even if someone does, isn't the performance of the two navy lieutenants on Long Island a few days ago rather breathtaking? During the war the fastest pursuit planes in action hardly made half of 266 miles an hour! and that is only five years ago.

Many of us are inclined to look upon aviation as a sporting proposition, too fraught with danger and too expensive to find a place in practical commercial transportation. But we must remember that the automobile started out the same way and made its first impression by its performance on the track.

Did any one in the early days of the automobile have any comprehension of what it would mean in American daily life in 1923? Very few, we believe, and even fewer can foresee what twenty years of airplane development will bring forth.

Shop Equipment News

Potter & Johnston 6-C Automatic Chucking and Turning Machine

The No. 6-C automatic chucking and turning machine recently announced by the Potter & Johnston Co., Pawtucket, R. I., while a development of the type of machine previously manufactured by this company, incorporates many new features both in design and construction.

The box bed is made with closed chambers to house the cams from which the various movements of the machine are derived and thus protect them from the interference of chips that might otherwise affect their functions. The headstock is built as a unit and can be lifted off the base without disturbing other parts. The unit feature of construction is extended to cover the cross-slide, turret slide, change gear boxes, etc., so that repairs may be made or changes effected in any of the individual parts without dismantling the whole machine.

The control cam is located under the headstock and is readily accessible for setting the dogs by removing a cover, shown in Fig. 1 at the front of the base. All movements of the machine are under instant control of the operator through the hand levers in front of the headstock. The machine can be equipped with a pneumatic control movement instead of the usual mechanical control and, when so equipped, the shifting movements are practically instantaneous, thus eliminating some idle time.

The work spindle is a high carbon steel forging 5¾ in. in diameter, with a 3½-in. hole clear through. The front bearing is 5¾x7 in., the rear bearing being 5¾x5 in., and the distance between bearings, 21⅜ in. The spindle gearing is all of steel, the heavy-duty gearing and shafts being of chrome-nickel alloy, heat treated, and running in a bath of oil. The bearings are flood lubricated.

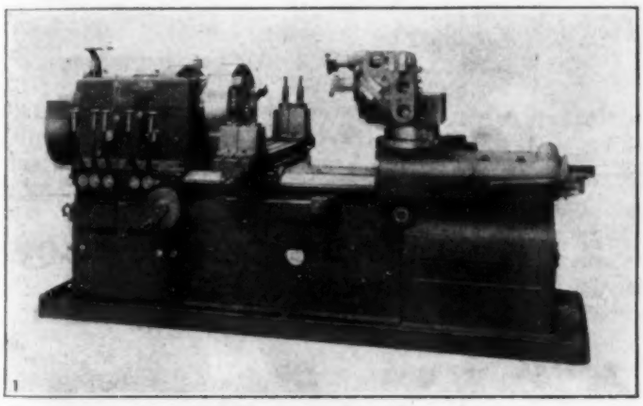
The drive is through a constant speed pulley, equipped with a friction clutch and brake. It should run at 650 r.p.m. There are four combinations of four automatic speed changes, giving 16 spindle speeds, increasing in geometric ratio from 9 to 185 revolutions per minute.

The feed gearing is contained in a box that is attached as a unit to the rear of the base, Fig. 2. There are eight combinations of three automatic changes of feed, making a total of 24 feeds, ranging from 0.007 to 0.250 in. per revolution of the spindle. The feeds are independent of the high constant speed for the idle movements of the machine, this constant speed being derived directly from the driving pulley. The feeds are driven from the spindle and change with its speeds, thereby preserving the ratio.

The cross-slide cam drum lies crosswise of the bed directly under the slide and the cam-roll stud is permanently driven into the cross-slide member so that the transmission of power is direct. This arrangement permits a wider range of movement for the cross-member than is usually obtainable, and at the same time makes a much stronger drive. The cross slide may be operated at the same rate of feed as the turret slide, and has a power-operated traverse of 6 in. from center in either direction and a hand adjusting range of 10 inches.

The turret slide is of rugged construction and travels upon ways so designed as to distribute the wear as evenly as possible. The front way is a modified form of inverted V, presenting one surface nearly perpendicular to the sidewise thrust of the tools. The other way is flat. The slide is provided with a hand-operated adjustment of 10 inches. The maximum power traverse is 18 in., approximately 15 in. of which is available for useful tool movement, the remainder being taken up by the functioning of the turret. A 4-, 5-, or 6-sided turret can be supplied.

The machine swings 29½ in. over the ways and 16 in. over the cross-slide. A three-jawed geared scroll chuck with standard jaws and wrenches is included in the regular equipment, and is provided with a pilot bushing to steady the cutting tools. The design of the machine permits overhead piloting also.



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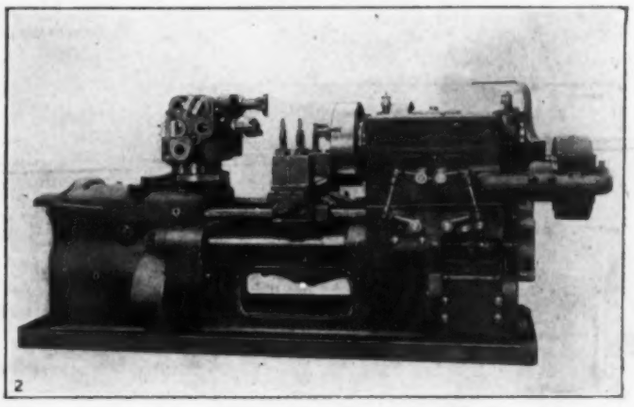

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FIG. 1—FRONT VIEW OF POTTER & JOHNSTON AUTOMATIC CHUCKING AND TURNING MACHINE
FIG. 2—REAR VIEW OF MACHINE

Since the drive is through a constant speed pulley and a friction clutch, the machine may be driven from line shaft, countershaft or independent motor with equal facility. The design of the headstock is such that a driving motor may be mounted upon it without alteration or further preparation, delivering its power through a standard silent chain.

The horsepower required ranges from 10 to 15. The machine occupies a floor space 139¾x35¾ in., and weighs 9,460 pounds.

Crescent G-38 Utility Truck

A short wheelbase, general utility truck, designated type G-38, has recently been placed on the market by the Crescent Truck Co., Lebanon, Pa. The over-all length is but 64½ in., folded, so that it can be driven upon a 66-in. elevator. This feature makes the truck of particular use for plants which were constructed before the day of the industrial truck, and in which the elevators and passageways are small.

The usual features incorporated

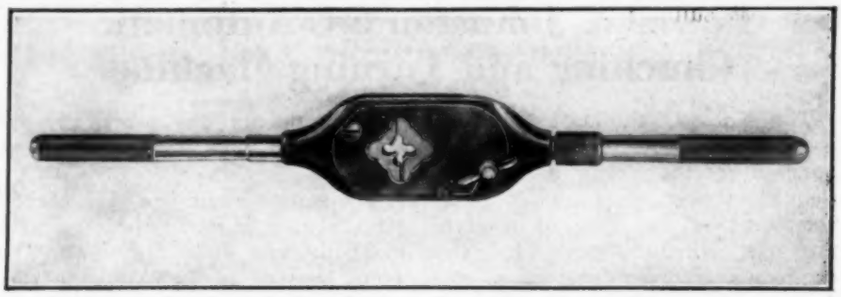
CRESCENT G-38 UTILITY TRUCK

in the trucks made by this company, and previously described in the *American Machinist*, are also found in this short model, which has a load capacity of 4,000 lb. and a platform area of 2,552 sq.in. The wheels are 20 in. in diam. and are four in number, 2 for driving and 2 for steering. The wheelbase is 38½ in., the tread at the front being 32 in., and at the rear, 36 inches.

The standard type of drive is installed and a G. E., 24-volt motor running at 1,200 r.p.m. is used. A Cutler-Hammer drum-type controller provides 3 speeds forward and reverse, and a sliding type, Cutler-Hammer safety switch is connected with the operator's platform.

Frost Adjustable Die Stock

A recent addition to the line of hardware and tools manufactured by C. L. Frost & Son, 30 Ionia Ave., Grand Rapids, Mich., consists of an adjustable die stock.



FROST ADJUSTABLE DIE STOCK

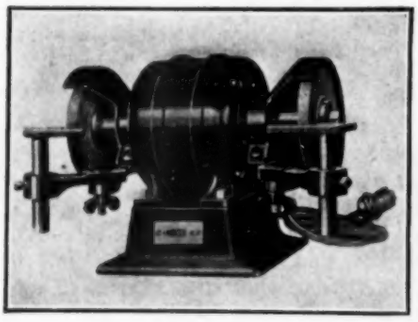
The tool is shown in the accompanying illustration, and its main feature is its ability to cut threads ⅛ in. over or under standard size. The adjustment is made by simply turning the handle and there are no setscrews to adjust. The amount of adjustment is shown on a scale at the side of the stock and the dies are locked in the required position by means of a knurled thumbnut.

A full set of these dies includes all standard sizes from ¼ to ¾ in., in both U. S. S. and S. A. E. form, with taps to match and suitable holders. It is stated that the split construction of the die allows the die to be removed from the work without reversing the threading action, permits the rechasing of worn threads, and makes possible the use of one die for more than one thread.

Bodine Portable Grinder

A recent addition to the line of electrical machinery and apparatus manufactured by the Bodine Electric Co., Ohio St. and Oakley Blvd., Chicago, Ill., consists of a portable, ball-bearing, motor-driven grinder. The machine is especially adapted for use in the different departments of a shop, giving the advantage of greater convenience.

The grinding-wheel spindle is



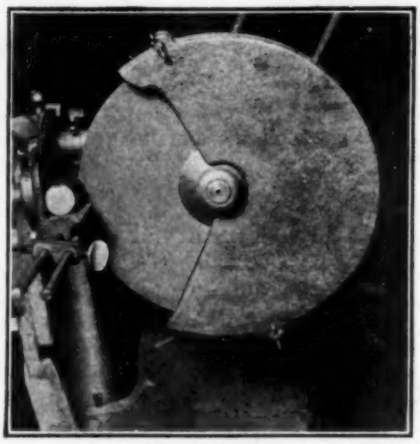
BODINE PORTABLE GRINDER

mounted in ball bearings, and a screw adjustment is provided to take up any wear that may occur. The tool rest is adjustable vertically and sideways, being clamped in position by a thumbscrew.

The wheel guard is heavy and the motor is protected by a dustproof casing. Arrangements are made for ample lubrication. The electric switch is mounted on the machine and a suitable attachment cord and plug is provided.

Aloxite Redmanol Cut-Off Wheels

The Carborundum Co., Niagara Falls, N. Y., is now marketing Aloxite cut-off wheels in which the bonding agent is Redmanol. Redmanol is a phenol resin of the same family as Bakelite and will not soften or melt, thereby giving an open, porous wheel structure which tends to produce a free, clean-cutting



ALOXITE REDMANOL CUT-OFF WHEEL

wheel that will cut without binding.

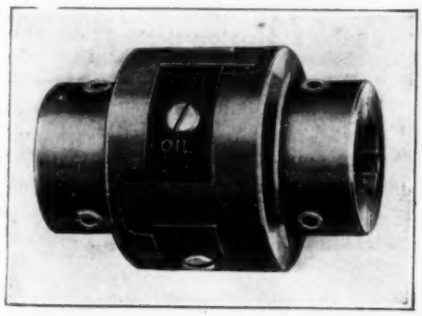
For the cutting of high speed and general steel alloys, for cutting stellite, and for miscellaneous cut-off work, it is claimed that these wheels will effect appreciable savings in time, stock and labor. Practice has shown that wheels 12 in. in diameter are most suitable for cut-off work and they can be made $\frac{1}{16}$ in. thick. Wheels of other diameters are also made, the diameters ranging from 8 to 14 in., and the thickness from $\frac{1}{32}$ to $\frac{1}{8}$ inch.

Various grades of wheels are provided for different materials. The 50K-grit, 4-grade wheel is recommended for stellite; 50K-grit, 6-bond, for miscellaneous work; and the 50K-grit, 8-bond, for high-speed and soft steel. For general cut-off work on materials of low tensile strength and for cutting carbons and brushes of graphite and copper, the 50C-grit, 4-grade wheel is used.

Higgins Flexible Coupling

The Tomkins-Johnson Co., Jackson, Mich., is now marketing the Higgins flexible coupling, the essential features of which are shown in the accompanying illustration.

A flanged member is fastened to the end of each shaft and a third member transmits the power between



HIGGINS FLEXIBLE COUPLING

the two. Lugs on the shaft members fit into slots in the middle piece, in such a way that both angular and axial misalignment of the shafts is possible.

The central member has a reservoir into which oil is introduced through suitable oil holes. This oil seeps through the porous material of which the piece is made and keeps the wearing surfaces of the coupling well lubricated.

When installed the middle member should always be free to float endwise a small amount between the shaft members of the coupling. The coupling will then drive without binding, cramping or backlash.

Edlund Tilted Production Drilling Machine

A tilted drilling machine, intended for use in production work and suitable for drilling small forgings or castings, has recently been placed on the market by the Edlund Machinery Co., Inc., Cortland, N. Y. The machine may be readily adapted for different classes of work by providing the necessary work-holding fixtures on the rotary table, and changing the feed gears and cams.

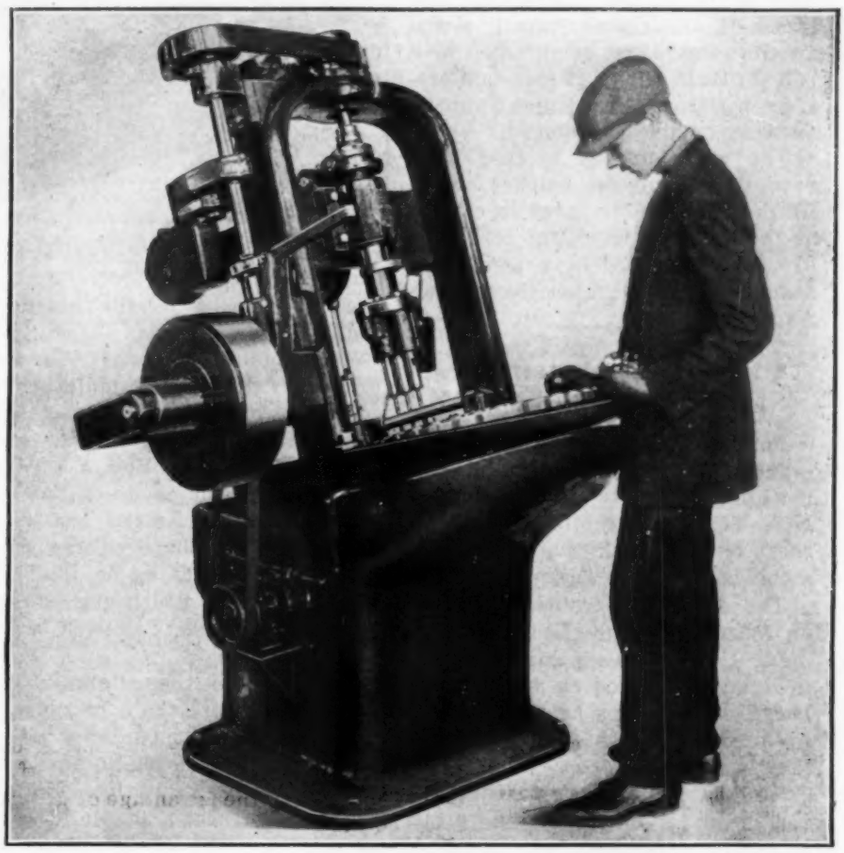


FIG. 1—EDLUND TILTED PRODUCTION DRILLING MACHINE

The machine shown in the accompanying illustrations is equipped for drilling $\frac{3}{8}$-in. holes in rim nuts of two lengths, $\frac{7}{8}$ and $1\frac{1}{8}$ in. On this work the machine will drill 700 of the latter and 775 of the former size, per hr. It is stated that one operator can easily run two machines and generally three.

The nuts are carried on the worktable in hardened steel bushings with hexagonal holes, the bushings being arranged in three rows in a steel ring which is indexed at each cycle of the feed cam. Three nuts are drilled at once by means of a three-spindle drilling head.

The drive pulley is mounted in radial ball bearings and drives a vertical shaft through a pair of bevel gears. The vertical shaft is in two parts, the connection between them being a square-tooth clutch operated by means of a lever conveniently located at the operator's left. This

FIG. 2—REAR VIEW OF EDLUND DRILLING MACHINE

clutch controls both spindle and feed, the spindle being driven by a Morse silent chain from the vertical shaft. The spindle is 1⅞ in. in diam. and 26 in. long. The drill head has hardened steel gears and is equipped with ball bearings.

The drive for the feed cam is taken from the vertical shaft above the clutch and it is possible to change the speed of the cam by changing two spur gears in the gear case. The camshaft is driven through worm gearing, the thrust being taken by a ball thrust bearing. A face-cam provides positive return for the spindle and may be quickly changed.

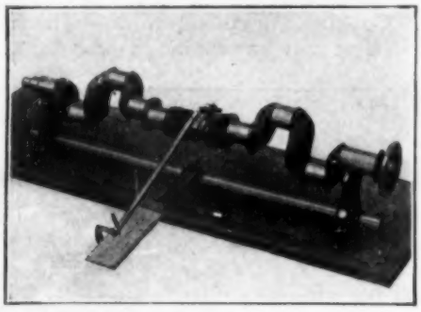
The work-table is indexed by a pawl which engages notches cut in its periphery. The pawl is carried at the end of a lever, the other end of which is moved by a cam. The same cam operates a positive ejector.

"Utility" Crankshaft Testing Machine

For testing used automobile crankshafts, both before and after machining, Utility Tools, Norfolk, Neb., is now marketing the crankshaft testing machine shown in the accompanying illustration.

The shaft to be tested is mounted on rollers which are fastened to the upper ends of two uprights. These uprights are placed on a long heavy bar, their positions being adjustable to accomodate shafts of various lengths.

The crankshaft shown mounted in the device is undergoing a test to show the parallelism of the crankpins in relation to the main bearings. For this purpose an attachment called a parallelograph and shown attached to one of the pins is used. This attachment is clamped over a pin and the rotation of the shaft causes the pencil at the outer end to trace lines on a sheet of paper. The sheet is held by a



"UTILITY" CRANKSHAFT TESTING MACHINE

bracket clamped to the horizontal rod of the device.

The configuration of the lines drawn by the pencil indicates the condition of the crank, a straight line at right angles to the center of the shaft indicating a satisfactory crank. Any deviation from the straight line indicates bad alignment, and the shape of the figure drawn also serves as an indication of the plane in which the crankpin is out of parallel, as well as the amount.

For testing the alignment and roundness of the main bearings, an indicator may be mounted on a suitable bracket attached to the longitudinal rod of the device. Rotation of the shaft then shows the wear or misalignment of the main bearings directly.

Customs Rules Will Be Simplified

The American section of the Chamber of Commerce has received a dispatch from Geneva, Switzerland, announcing the conclusion of the International Conference on Customs Formalities, which has been in session for three weeks. As a result of this conference, 34 nations are signing a detailed international convention aimed at overcoming many of the most vexatious aspects of customs regulations and customhouse procedure in international trade. Although the United States government has not officially taken part in the deliberations, representatives of the United States Department of State, the Department of Commerce, the Treasury Department, and U. S. Tariff Commission, have been present throughout the meeting. Likewise, in a consulting capacity, the International Chamber of Commerce, with a delegation headed by former President Clementel, has had a big share in the conference, presenting the point of view of the business of the various countries. Many of the measures adopted were suggested by the International Chamber of Commerce, and a number had their origin in a report submitted by the American Section of the Chamber.

When this convention comes into force, some of the following improvements in customs matters will be accomplished: Harsh financial penalties for clerical and other trivial errors in documents will be a thing of the past. Advertising matter will receive lenient and liberal customs treatment. Consular office hours in connection with the certification of invoices and other trade documents will coincide with the hours of business houses. Consular invoices and certificates of origin will be standardized, and exporters will no longer have to master the intricacies of the scores of varying documents. The customhouse treatment of commercial travelers and their samples will be greatly simplified. Customs inspection of travelers' baggage on trains crossing European frontiers will take place on the trains, rather than requiring passengers to get out and go to the customhouses. A permanent international body of customs experts will be established with headquarters at the Secretariat of the League of Nations in Geneva to deal with international customs disputes. There will be full and prompt publication by each nation of changes in its customs tariffs and customs regulations, and customs publications will be distributed through a central office at Geneva, the International Bureau of Customs Tariffs at Brussels, the headquarters of the International Chamber of Commerce at Paris, and the Inter American High Commission at Washington.

"This Conference," said the American Section of the International Chamber today, "has been a conspicuous example of a great international gathering where business men organized in the International Chamber of Commerce have sat down with government officials, and in a brief period arrived at valuable common agreements."

Far Eastern Business Increases

Figures just released by the Far Eastern Division of the Department of Commerce indicate that our total trade with the Far East during the first nine months of this year shows an increase of more than 25 per cent over the same period of last year, in spite of unsettled conditions in China.

The Far East now accounts for about 22 per cent of our total trade, compared with only 12 per cent ten years ago. Modern transportation facilities are rapidly bringing the Orient nearer to our door and without doubt we shall witness a trade development during the next decade that will outstrip the record of the last ten years, in which this trade increased threefold.

In the full calendar year 1913 we took from the Far East commodities, mainly crude, valued at only $314,078,218 while during the first nine months of the present year our imports from that section aggregated $835,990,611.

Our exports to the Far East which consist largely of manufactured products have shown a similar growth during the same period, increasing from $194,159,465 during the full year of 1913 to $442 260,490 for the first nine months of 1923. The increased purchasing power of the peoples of the Orient, which has raised their standard of living, coupled with the industrial movements in Japan and India, have combined to cause this increased consumption of our manufactured products and machinery.

All the principal Far Eastern countries, with the exception of China, and British India, took more goods from the United States during the first three-quarters of 1923 than during the corresponding period of 1922, while their exports to us were greater in every instance. Japan which heads the list of our Far Eastern customers took goods valued at $163,400,565 during the first nine months of 1923, compared with $155,127,603 during the same period of 1922. During the month of September our exports to Japan were almost $10,000.000 greater than during the same month last year.

News Section

Chamber Committee Recommends Many Transportation Changes

A comprehensive plan for linking organized motor transport with the railroads in the development of a balanced national system of transportation is outlined in the report of the Committee on the Relation of Highways and Motor Transport to Other Transportation Agencies submitted recently to Julius H. Barnes, president of the Chamber of Commerce of the United States.

Sweeping changes in prevailing methods of handling and distributing freight are proposed. Store-door collection and delivery to relieve congestion within the crowded terminal areas of large cities, the use of organized and responsible motor transport to relieve the railroads of various forms of uneconomical service, including the unprofitable short haul, the wider use of self-propelled railway cars and the extension of passenger bus service to supplement existing facilities are recommended.

To pave the way for these changes in the public interest the committee suggests the regulation of common carrier operations of motor vehicles by the federal and state commissions which have supervision of rail and water carriers, and the systematic development of highways in response to general traffic needs that are so necessary.

The committee, of which Alfred H. Swayne, vice-president of the General Motors Corp., is chairman, is one of five designated by the president of the national chamber to study different phases of the transportation problem and lay the ground-work for a national policy to be discussed at a general transportation conference to be announced later. Its recommendations represent the unanimous view of all the important interests directly concerned in or affected by transportation. Its personnel includes railway traffic officials, officers of farm and labor organizations, representatives of the motor industry, motor haulage companies, water carriers and the shipping public.

In connection with the report there has been published by the Chamber of Commerce four other reports made which bear relation to transportation and have been circulated by it for consideration in advance of the national transportation conference. Two of these reports are: "Development of Waterways and Co-ordination of Rail and Waterway Service" which is a report of Special Committee V; and "Taxation of Transportation Agencies" which is the report of the Joint Committee. Other reports will be issued.

Citroen Gives Dinner to Representatives

An unique industrial entertainment was given in Paris recently when André Citroën, the well-known automobile manufacturer, invited five hundred representatives of the concerns that supply him with raw materials, parts, accessories and machinery to a banquet at the Palais d'Orsay. The great banquet hall and reception rooms, when the guests were assembled, resembled a huge convention.

The object of the entertainment, Mr. Citroën explained, was to bring about a closer rapproachement between the Citroën works and its purveyors and to acquaint the latter with the plans and prospects of what has become for France an undertaking of far-reaching importance.

In his opening remarks, Mr. Citroën stated that his present production of 140 cars per day is insufficient to care for the demand and that it had become necessary to greatly increase the output. The immediate increase contemplated is to be 60 cars per day, to be attained by March 1. This figure, while it would not satisfy the demands now being made upon him, he considered to be a conservative venture, especially in the light of the growth of the export trade, which in 1924 will call for 16,000 Citroën cars of a value of 200,000,000 francs (at present exchange rates about $12,000,000). He called special attention to the importance of these figures upon the foreign trade of France and upon the rate of exchange.

Mr. Citroën further stated to his guests that he had caused a thorough investigation to be made of the responsibility and capacity of the concerns represented among the diners and could assure them that as long as they succeeded in helping him satisfactorily to meet the demands made upon his works he would continue to patronize them to the exclusion of all outside competition.

Among the guests were numerous representatives of American manufacturers.

Report on Employment in Coal Mines

The irregularity of employment in the coal mining industry has been studied and a comprehensive report has just been sent to President Coolidge and Congress by the United States Coal Commission. The report was prepared by Horace B. Drury working under the general direction of Dr. Willits, and he was assisted by Miss Bezanson and Anna S. Porterfield. Some of the data was also obtained from the United States Geological Survey.

The report is divided into two parts, the first under the title of "Employment, Intermittency of Employment and Absenteeism in the Bituminous Coal Industry." In this part the number of men working, the hours worked, the days missed either through their own fault or through lack of work, the overtime question, and many other phases are treated. In the second division entitled, "Opportunity for Employment and Time Worked by Men in the Anthracite Coal Industry" practically the same questions are studied and reported as in the bituminous field. There are many interesting charts and graphs showing employment and production in both the bituminous and the anthracite fields in the different sections of the country.

New York Meeting of Welding Society

The New York Section of the American Welding Society made quite a success of the first meeting of the season on Nov. 13. T. F. Barton, president, started by telling of the Fall meeting of the Society that was held in Pittsburgh. A discussion as to the circumstances under which to employ different types of welding was given by C. J. Holslag of the Electric Arc Welding & Cutting Co. Mr. Holslag recommended gas welding for thin work under 14 gage, electric arc welding for medium work, and thermit welding for very heavy work.

An interesting motion picture showing the manufacture of wire beginning with the raw materials and going through the different processes, was presented by W. H. Bleecker of the Page Steel & Wire Co.

Major James Caldwell from England told of the development of flux-covered electrodes. The application of arc welding to fuel tanks was discussed by Pliny P. Pipes, welding engineer of the Lincoln Electric Co.

American Committee to Power Conference

The American committee to the first World Power Conference to be held at the British Empire Exhibition, Wembley, London, has been announced. The conference will be held June 30 to July 12 and is promoted under the council of the British Electric and Allied Manufacturers' Association in co-operation with the technical and scientific institutions and industrial organizations in Great Britain and other countries.

The committee consists of the following: Hon. John W. Weeks, Hon. Hubert Work, Hon. H. C. Wallace, Hon. Herbert Hoover, Gen. Guy E. Tripp, Owen D. Young, Samuel Insull, Prof. Lester Paige Breckenridge, Sidney Z. Mitchell, O. C. Merrill, H. J. Pierce, W. M. Stewart, H. M. Addinsell, Peter Junkersfeld, Calvin W. Rice, David B. Rushmore, Calvert Townley, John W. Lieb and Fred R. Low.

Machine Tool Business Brisk in the Chicago Territory

Industrial buying looks more promising than for some time and the railroads have been active this week. The Rock Island, R.R. has purchased three milling machines, a screw machine, a staybolt threading machine a motor-driven heavy duty turret lathe and a grind wheel. The Illinois Central R.R. purchased 3 bolt cutters and a lathe, the Burlington R.R. has almost completed purchase of its long outstanding list of some 80 machine tools, including 25 lathes ranging from 18 to 30-in. swing and six heavy duty shapers. The lathes were purchased from Manning, Maxwell & Moore. While all dealers are selling a few machines from the floor, business continues comparatively quiet.

The Baltimore & Ohio R.R. is in the market for a 90-in. journal turning lathe; two 36-in. upright drills; one guide bar grinder; two driving box boring and facing machines; one 7-ft. radial drill; two 16-in. engine lathes; one drill grinder; one 20-in. upright drill; one 24-in., one 28-in. and one 30-in. shaper. The Norfolk & Western R.R. has an inquiry out for one 4-in. radial drill; two 6-ft. radial drills; one 26-in. upright drill; one nut facing machine; two 20-in. engine lathes; one universal cutter and tool grinder; one 36-in. draw cut shaper; one link grinder; five 16-in. engine lathes; one No. 12 universal milling machine; and one 60-in. engine lathe.

A buyer for a concern in the Southern part of Illinois has made inquiry for about $35,000 worth of equipment and a Chicago industrial is asking for prices on about $50,000 worth of machine tools. A planer and two lathes were sold to a Milwaukee manufacturer who is in the market for additional equipment. A couple of lathes were sold to the Remy Electric Co., Anderson, Ind.

The Baltimore & Ohio R.R. has ordered 500 hopper bodies from the Pressed Steel Car Co. and 500 box car bodies from the American Car & Foundry Co. The demand for steel bars has been heavy for several weeks. Auto wheel manufacturers and bolt and nut makers have been unusually active in the market. In structurals, fabricators are figuring on projects involving 20,000 tons of steel and architects have plans which call for approximately 80,000 tons, according to reports here this week.

Some of the machine tool representatives are inclined to credit this to the fact that the end of the year is approaching and that annual reports must be made up. Those who hold this belief expect that a number of the present inquiries will be closed immediately after the beginning of the new year. Others are not so optimistic.

There is little selling of machinery in the contractors' field. Business, which was very good up to this time, has fallen off rather sharply since October. It is expected that inquiries will be out shortly for machinery for use in connection with the construction of the new Kenmore Boulevard and there will be some state road lettings within a month or so. About the only thing selling in this line right now is a few pumps and smaller equipment for immediate needs.

Few cranes have been sold in the Buffalo territory within the past few weeks. One firm reported the sale last week of a five-ton electric traveling crane to the Power Specialty Co. of Dansville, N. Y., and another machine of the same size to Pratt & Letchworth, Inc.

Industrials Buying in New York

Dealers in the New York district report this week that so far during the month of November business has been fair and of a steady nature. Buying has not been as brisk as they had expected, but nevertheless on a comparison with the Summer months it is a great improvement. Industrials in and around New York have shown more interest in purchasing during the past week than they have in a long time. Many small sales have been consummated and the total is most gratifying. There have been some expansions recorded and many inquiries from industrials showing that at the present time there is great faith in the future among users of machine tools.

Will the Railroads Buy?

The anticipated buying by the railroads has not materialized, although all dealers are anxiously waiting some flurry to indicate that this buying will take place before the first of the new year. It was generally believed that the roads would make purchases toward the last part of the month and, while the month is not yet over, there seems to be a feeling that the railroads may let these necessities go over until after Jan. 1.

Automotive buying has not been of any propertion during November, but dealers have full confidence in the production schedules that have been planned by the automobile makers and consider this business their "ace in the hole" for next spring and Summer.

Improvement in the textile field is expected within a few weeks and one dealer stated that some inquiries were coming out of New England, while small sales were continually being made to Southern textile manufacturers.

Used tools found a fairly good market during the past week, but the future prospects do not look as encouraging as in the new tool industry.

Japanese buying is reported by several firms. Truck makers are all getting business and one motorcycle company recently made a big shipment of its product to Yokahoma. Other export business is good and, with the exception of Europe where nothing of a business nature is certain, better export business is anticipated.

More Inquiries in Buffalo District

There has been little change in the machine tool market of the Buffalo territory during the past couple of weeks, excepting that in some cases representatives in this field are slightly more optimistic than they have been for some time because of the more lively interest being evidenced by manufacturers in some lines.

For example, some of the automobile and automobile accessory manufacturers of this city who have been practically off the market for some time are again asking for quotations to fill their machine tool needs. One inquiry is out for five milling machines and four shapers and another list of four lathes. Several inquiries for smaller tools are out.

Railroads of this territory are not buying machinery now, the only inquiry to be noted at this time being one by an Eastern railroad for a heavy duty coachwheel lathe for replacement purposes in its Buffalo shops. Some of the non-ferrous metal manufacturers are making small purchases at this time.

The tendency of the trade not to close deals very quickly is quite noticeable now, as it has been since last Spring.

More Inquiries in New England

Among the chuck manufacturers of the Hartford district the belief is that the volume of business for 1923, for which figures are now being assembled, will run from fifteen to twenty-five per cent better than for 1922. Two manufacturers have figures which indicate this improvement in the business of this year and others "guessed" at a percentage even higher. Working organizations, as a whole, have been maintained right along since the war and only in a few instances where there were great war time expansions working forces have been reduced.

A much better condition obtaining in the machine tool manufacturers is also indicated in the interviews with heads of organizations. The automatic machinery industry has been comfortably busy continuously and still is. A solid interest was indicated in the inquiry mail of one manufacturing firm for the past week, the volume of which was considerable in excess of $100,000 in business. There was a heavy inquiry mail in another manufacturing concern two weeks ago, the result of which netted $50,000 in orders already.

Automatics Improving

Conditions will continue to improve in the automatic machine trade for several months, it is stated, with a possible let up in some lines for brief periods.

The dealers in used machine tools report a comfortable business, the sales are somewhat higher than at the corresponding period a year ago.

Special machinery builders report an active interest which, when materializing into booked orders, is going to produce a big movement in the machinery trade. Much of this is bound to materialize, although the facts already at hand are clear that it will not be forthcoming for from four to five months at the earliest.

Increased automobile production will be reflected in the machine tool industry in this section in the Spring and early Summer it is anticipated.

Milwaukee Business is Fair

Although it is not a common experience among local manufacturers in the metalworking industries, purchases of machine tools so far in November have been somewhat larger in number than the October average. The majority of concerns, however, are unable to report any improvement and the sales curve has continued to take a horizontal course, if not drooping somewhat.

Tool trade is quiet. Inquiry is fair, but probably for the simple reason that prospective buyers are doing an unusually large amount of "shopping" to find the particular class of tool they need at a price they feel they want to pay. A dozen inquiries may mean only a single tool in the final analysis.

Extensions of plant capacity are becoming rare instances. Owing to high building costs, to say nothing of the inability to get the requisite quantity of suitable labor, have been discouraging the enlargement of foundries and machine shops. More recently the cautious and extremely conservative attitude of customers of such shops with respect to placing orders for nothing but current needs has made it quite unnecessary for production shops to consider enlargement of capacity. Machine shops have good orders for delivery between now and the end of the year, but judging by existing conditions, they are not going to carry much unfilled business on their books into the new year, as they did a year ago. Under these circumstances there are few concerns willing to make any substantial investment in plant additions and equipment which may for some time to come prove excess capacity.

Autos Best Customers

The automobile trade continues probably the best customer of the machine tool industry, yet the volume of sales is far below the average for the first half of the year. Certain of the principal producers are buying in small lots but the great majority of shops seems to have come to a point where buying is for replacement only.

Railroad business placed with local tool shops is hardly to be reckoned with as to volume, yet it comes next to automobile buying.

Manufacturers of woodworking machinery are filling some needs in a small way. With regard to sawmill business, the bulk of needs is filled with full complements of equipment derived from mills which have been abandoned owing to the exhaustion of the major timber supply in the locality. Tools for working hardwoods into stock for automobile and bus bodies are in relatively the best request.

Contractors' equipment, such as concrete mixers, hoists, etc., is moving fairly well, but factories are slowing down pending developments in the building situation in 1924, following the greatest building season on record.

There has been no recovery from the slump in demand from the oil producers for equipment, following the partial collapse of prices in the industry. Mining equipment is rather slow, especially among copper producers.

Municipal buying of water, light and power machinery is largely completed for the present, but it is confidently expected that after Jan. 1 considerable of this business will be placed. The same is true of hydroelectric generating machinery for both private and public utilities.

Canada Views Future with Optimism

In view of the general conditions in Canada, which have been quiet during the last two weeks, machinery and machine tool sales have not been large. However, sales of small lots of equipment for replacement purposes amount to a fair total and jobbers believe the trend is upward. The city of Montreal reports machinery sales to be in fair volume, while individual orders are not large. Railroad buying has been done to a limited extent. In Toronto sales have slightly improved, but the call from general industry is lagging.

In so far as eastern Canada is concerned much significance attaches to a recent statement by Premier Armstrong of Nova Scotia who has just completed a tour of the industrial centers of his province. Discussing the conditions in the various centers he said: "The rail mill at Sydney reports that orders now on hand and pending will mean full time operation up to June 1924. The other various centers report greater activity than at this time last year, and in a number of instances are being conducted at practically full capacity. During 1922 pig-iron production was 120,769 gross tons; this year it is believed the production will reach fully 285,000 gross tons, an increase of about 136 per cent.

An optimistic outlook for the future of the Canadian National Railways is reflected in a statement issued this week by J. E. Dalrymple, vice-president in charge of traffic, in which he declared the present volume of business was greatly exceeding that of last year and the improvement in the financial returns of the system during the first eight months of the year would be accelerated during the coming months if general conditions continue as they are at present.

Building in Canada

Structural material is showing a natural seasonal decline after an active Summer and the number of large building projects on hand is small. On the other hand, small building projects have been registered in numbers unusually large and manufacturers of building hardware look for considerable activity. During October construction contracts awarded throughout the Dominion, according to MacLean Building Reports, Ltd., amounted to $30,000,000, compared with $23,382,100 in September, and $24,270,300 in October, 1922. Business buildings amounted to $4,345,600; industrial buildings, $1,329,000. The value of contemplated new work during October was $33,968,000.

There has been noticeable improvement in the textile situation, and extended operations on the part of producing plants have been the rule.

On the Pacific coast, business has shown a satisfactory improvement, but the change is seasonal rather than fundamental. A number of logging camps which had been closed have resumed operations, as the surplus stock is becoming exhausted. Interior mills are doing fairly well.

Detroit Plans Bigger Auto Output

Announcement made last week that the Ford Motor Co. is planning on a production of 10,000 cars daily by the first of February, 1924, and the continued record-breaking achievements among other firms point to the most prosperous period in Detroit's history.

A survey has been completed by the Board of Commerce showing the activity in the major lines of the city, a survey that clearly indicates the trend of the period.

In the Board's official publication, *The Detroiter*, the following statements are made:

"Business in Detroit is moving along on a sound and more or less conservative basis. It is better than it was at this time last year; more men are working, there is more money in the banks, and neither manufacturers, retailers nor wholesalers are carrying heavy surplus stocks, which in itself is a healthy condition."

In the survey bankers, stove manufacturers, adding machine manufacturers, retailers, brick manufacturers, paint and varnish manufacturers, wholesalers, automotive leaders, real estate men, and others were interviewed. Optimism was the sentiment expressed by all.

The stupendous program planned by Ford, if the factory resumes the three-shift, 24-hour plan, means that seven cars a minute, or about one car in every eight seconds, will be turned out in the Highland Park plant and the assembly branches throughout the country.

All Factories Busy

The situation existing at the Ford plant is said to be typical of most of the factories manufacturing better known cars. The Willys-Overland factory plans an output of 18,000 cars this month and the 1924 production schedule will call for an output far in excess of the 200,000 Willys-Knight and Overland cars that will have been turned out by the end of this year.

President Sloan of the General Motors Corp. in a recent statement announced a greatly increased production program at the Chevrolet plant with the monthly output ranging around 50,000, while the "step-up" order at the Buick plant is equally as great in comparison. The same is true of Olds and Oakland, the speed-up extending also to the higher grade automobiles, with Cadillac schedules, according to General Motors officials, exceeding those of any production program heretofore maintained.

Dodge Brothers, Hudson-Essex, Maxwell-Chalmers, Studebaker, Packard, Lincoln, Paige-Jewett, Reo and Rickenbacker are revising schedules upward to meet what is declared certain to be a steadily increasing demand with the coming of the new year and the stimulus of the national Shows in January in various parts of the country.

Traffic conditions on the railroads continue to give good promise, with movements higher than has been known at this time for years.

The navigation season is drawing rapidly to a close, and by the end of the month movement via water between lake ports wil have become practically negligible.

Machine Tool Manufacturers Sending Engineers to Russia

Engineers representing machine tool builders of this country will accompany H. Saxon, of the Allied American Corp., New York City, to Russia upon his return to that country during the last week in November. Mr. Saxon went to Russia some time ago to establish the engineering department and after an exhaustive study of conditions abroad decided that the interests of American concerns could best be furthered by direct representation in Russia by competent engineers. American machine tools have been purchased by Russians to a considerable extent and both orders and inquiries have been received during the past six months by firms that have joined with the Allied American Corp. in going after this business.

The following companies will send engineers with Mr. Saxon: the Union Twist Drill Co., the American Tool Works Co., the O. S. Walker Co., E. Horton & Sons Co., the Vitrified Wheel Co., the U. S. Machinery Co., the Simonds Manufacturing Co., the S. W. Card Manufacturing Co., the Wilmarth & Morman Co., the National Supply Co., the Bethwith-Chandler Paint Co., and several others.

"Since the overthrow of the Czar," stated Mr. Saxon, "there have been twenty-two forms of government in Russia. Those who are responsible today have been the only ones who have been able to bring the country out of chaos and into order. There is not a doubt that things were in a bad shape two and three years ago, but at the present time an entirely different condition exists. If there are no further disturbances—and certainly none are anticipated—Russia will be the same great commercial power that she was fifty years ago but with a more equal distribution of wealth and with less monarchistic tyranny and oppression.

"It is imperative that American manufacturers have their own representatives in Russia if they are to do business. Secretary Hoover's recent speech before the American Marine Congress at the Hotel Astor on Nov. 9 stressed this point and we are doing everything to encourage manufacturers in this country to extend their trade in Russia, which, if properly managed, will be one of our best customers within five years. Intelligent representation and absolute honesty in all commercial dealings will carry American machine tool makers a long way with these people. Germany, England and France are lively bidders for Russian business because they understand the stability of resurrected Russia and have not been blinded by insidious propaganda against the present government."

Worcester Engineers Hold Meeting

Captain L. P. Crim of the Ordnance Department of the army, who is in charge of the obtaining of supplies in the New England district opened the program at the dinner of the Worcester branch of the American Society of Mechanical Engineers on Monday, Nov. 12. His subject was "American Society of Mechanical Engineers and Industrial Mobilization."

He advised every member present to aid the army in peace time to prepare for war.

D. F. C. Langerberg, a native of Ohio receiving a degree from Ohio University and D.S. in metallurgy at Harvard University, spoke on "The Investigation of the Influence of Temperature on Charpy Impact Value of a Group of Steels of Varying Compositions."

He is a metallurgist at the Watertown arsenal, and also a director of the testing laboratories at Watertown. He showed by pictures the influence of temperature on different kinds of steel.

Gen. T. C. Dickson, formerly a member on the staff of Gen. George Goethals as inspector of shops in the construction of the Panama Canal, and during the World War, brigadier general and assistant to the chief of ordnance, spoke on "X-ray Examinations of Metals," showing in pictures how the white spots on the film show cavities. He also pictured and explained how the bombs were photographed and X-rayed. "The X-ray," he said, "aids the designer and the shopman in detecting the holes in the guns and bombs."

The Tech Musical Association entertained during the dinner. Winthrop G. Hall was the presiding officer, while Prof. Howard P. Fairchild was in charge of the program. Dr. Ira N. Hollis, president of Worcester Polytechnic Institute, entertained the speakers at his home and interesting trips to various parts of Worcester Polytechnic Institute were made.

Mr. Hall announced that the New England section of automotive engineers will meet in Hotel Bancroft, Dec. 4. J. H. Nelson of the Wyman & Gordon Co. will speak on "Drop Forgings as Applied to the Automobile Industry."

New Oakland Factory Is Completed

Extensive alterations and new machinery equipment which have resulted in practically remodeling the entire interior of the Oakland Motor Car Co. factories finally have been finished. The machinery and alterations have involved an outlay of approximately $2,000,000, which is in addition to the new $2,000,000 Fisher Body Corp. factory, completed a month ago, adjacent to the Oakland factory, to build Oakland bodies.

This outlay of $4,000,000 gives the Oakland plant a capacity of 500 cars a day, twice its previous capacity. The company has reached an output of 300 cars daily, which is above peak production in the banner months of 1922.

Improvements to facilitate production have been the establishment of a complete conveyor system throughout the factories and the installation of immense new machines of special design which combine operations that formerly required several machines. These enhance the accuracy of manufacturing methods in addition to the productive facilities.

Tunnels connect the various plants and through these underground passages, a monorail system of conveyor speeds the unfinished products from factory to factory for the final assembly. All handling of the heavy parts of the car has been made automatic insofar as possible.

By the installation of almost entirely new machinery in the engine plant, new specially designed tools and a conveyor system, the production of the motor plant has been doubled, besides affording room in the same building for a complete axle plant.

St. Louis Business Declines

A further decline has been registered in the metal trades business here lately and a consequent falling off in the sale of machine tools. In some instances working forces have been reduced. The railroads, quiet all year in the matter of buying, have become even worse customers lately. Evidently they have stopped active buying until the budgets for the new year become operative when it is expected they will be more active. The amount of inquiries received has not shown a great increase.

The Medart Manufacturing Co., maker of overhead transmission machinery, reports that although its business is now a little more quiet than it has been lately, it is pleased with the outlook for a good business in 1924. Officials say that it cannot be classed as dead with them right now and they recently received a large contract from the Bethlehem Steel plant at Lackawanna, N. Y.

Firms which depend upon the oil fields of the Southwest for sales of machines are doing very little now and the consensus of opinion is that better conditions may be expected in that section of the country within the next 60 days.

The automotive industry is experiencing a slight letup in production here and consequently they are not in need of tools. However, that business is never of any great proportions as most of the automobile plants are assembly stations and not manufacturing units.

Discuss Cost Records in Machine Shops

Methods of keeping an exact cost record of all articles manufactured in the foundry and machine shop in order to determine the exact selling price, was the principal subject dealt with at the special meeting Nov. 13 of the Georgia Division of the Southern Metal Trades Association, held at Columbus, Ga. John S. Schofield, vice-president for Georgia, and president of the John S. Schofield's Sons Co., of Macon, Ga., delivered the address, with an expert accountant present who illustrated the methods used by this company.

It was the consensus of opinion of the membership present, which was representative of the foundry and machinery industries of the Southeast, that business is slowly improving, and that the outlook for the first quarter of 1924 is excellent.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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HAVING reached Chicago on the way from the Southwest to New York I find myself in an environment where the interest is less exclusively agricultural than in Texas. Perhaps I should add that political matters are also much in the minds of people here for three possible presidential candidates have been in Chicago this week and there is no little speculation as to the effect that the campaign and election of 1924 will have upon business.

The prevailing opinion is that there will be no unsettlement. Most of the men of affairs interrogated express the opinion that the country is safe no matter who is elected and that as one prominent merchant put it, "these Western radicals lose their terror when you get close to them."

Secretary Mellon's proposal to reduce taxes is approved in principle, but its adoption is hardly hoped for because it is generally believed that Congress and the President will be unable to resist the demand for a soldiers' bonus.

Business is said to be good everywhere except in certain sections of the Dakotas, Montana and Minnesota, where a poor wheat crop, sold at low prices, has caused some distress and a few bank failures.

The Wheat Council of the United States in session here has recommended a reduction of 10,000,000 acres in the area to be planted in wheat next year. There is the usual skepticism with regard to action upon this recommendation, but those who are best acquainted with the farmer say that he has come to appreciate the value of co-operation and that he is not likely to disregard the advice or mandates of the agricultural organizations.

The low price of wheat is, however, largely offset by the very satisfactory market for the large corn crop, and where both cereals are produced there is but little complaint.

Therefore it is not surprising to read that the retail trade shows a gain of 10 per cent over last year, that an enormous holiday business is expected, and that the mail order concerns find it difficult to keep abreast of their orders.

The advance in the New York stock market and the readiness with which the large bond issues recently brought out have been absorbed have increased the prevailing optimism, which has been further stimulated by the cheerfulness of the railroad men who are almost unanimous in expecting a continuance of the present heavy traffic throughout the Winter.

One of them told me that the passenger travel to California had been and promised to be the largest on record and in the West as in the East there seem to be an unusually large number of people who are able and willing to take a holiday this Winter.

The idleness of so many able bodied and potential producers may be undesirable from the economist's standpoint, but its immediate effect is to put money in circulation and to provide a multiplicity of jobs at good wages for those who are willing to work.

The result is an appearance of opulence and a disregard of small expenditures. One manifestation of this is to be found in the experience of a large chewing gum concern, the market value of whose capital stock has risen to $73,800,000. Attention has been drawn to it because it has just declared a large stock dividend.

> "The demand for automobiles during what is usually the dull season is really phenomenal and the fluctuations of motor car sales in recent years have coincided so closely with the nation's prosperity or depression that the industry is coming to be regarded as barometric. . . . The demand for steel is again improving and copper is active at 13½ cents. Orders for pig iron are improving after a long period of quietness."

Another example of the same kind is a company that makes and operates the taxicabs that are now to be found in all the large cities and most of the smaller places. Its prosperity is remarkable because people no longer hesitate about paying cab fares. The taxicab development is in fact amazing and only second in importance to the road building movement to which allusion has previously been made in these letters. The demand for automobiles during what is usually the dull season is really phenomenal, and the fluctuations of motor car sales in recent years have coincided so closely with the nation's prosperity or depression that the industry is coming to be regarded as barometric.

In so far as the commodity markets are concerned the general tendency appears to be upward, but those who deal in cotton goods say that they are commencing to encounter some protest against the higher prices recently established.

The demand for steel is again improving and copper is in active demand at 13¾ cents. Orders for pig iron are improving after a long period of quietness, and nearly everyone believes that prices are about as low as they will go.

Other staples are moving freely at about last week's levels and most merchants have ceased to expect any decline.

This is equally true of those who postponed building or construction work because of the high prices of materials and they are taking advantage of the declines which have already occurred by going ahead with their projects at an unusually rapid rate for so late in the season.

Rumors that changes will soon be made in some of the Federal Reserve Banks' rediscount rates have been in circulation but there is nothing in the trend of the money markets to warrant them, for the credit supply and demand are varying but little and the Federal Reserve ratio, which is now 75.6 per cent, has changed but little in many weeks.

Here, as in the Southwest, the majority of business men are apparently oblivious of Europe. The return of the Crown Prince to Germany, the threatened emergence of the ex-Kaiser, the decline in sterling and the French franc, the impending dissolution of the British parliament and the general election to be held in England on Dec. 6 are hardly mentioned or discussed as factors in the American business situation.

When asked whether he thought this disregard of conditions overseas was wise or safe, one banker answered me by referring to the report of our foreign trade for October. It shows exports valued at $402,000,000 and imports worth $303,000,000.

"Don't tell me," he said, "that Europe is bankrupt when she is doing business on such a scale."

Whether this view is sound only time can tell, and meanwhile the great Middle West is prosperous and becoming somewhat exultant in its prosperity.

Dr. Johnson Named as Exchange Professor

The appointment of Dr. Douglas W. Johnson as exchange engineering professor to France is announced. Dr. Johnson, the third American to receive this honor, has been professor of physiography at Columbia University since 1901, and is internationally known as an educator, author and scientist.

Serving for the next academic year, he will represent seven institutions on the Atlantic Coast with which the National Department of Public Instruction in France has established exchange relations in engineering and applied science. These institutions include Cornell, Harvard, Johns Hopkins, Massachusetts Institute of Technology, University of Pennsylvania, Yale and Columbia.

Personals

D. DEVRIES, a director of R. S. Stokvis & Zonen of Rotterdam, Holland, arrived in the United States last Saturday. He will be here for some time with his headquarters at the New York office, 17 Battery Place.

JOSEPH T. RYERSON of Joseph T. Ryerson & Son., Inc., Chicago, has been elected a trustee of the University of Chicago.

FREDERICK E. MOSKOVICS, who recently resigned as vice-president of the Nordyke & Marmon Co., Indianapolis, Ind., has been appointed receiver for the Stevenson Gear Co., Indianapolis.

O. L. HENN, factory manager with the National Acme Co., is now in the general office of that company at Cleveland.

DONALD C. EVANS has resigned as assistant general manager of the Denby Motor Truck Co. He has not disclosed future plans.

B. C. HOLDER has been appointed manager of the Maritime branch of the Frost & Wood Machinery Co., with headquarters at St. John, N. B., succeeding W. F. BURDITT, who retired last June. Mr Holder has been connected with the Maritime branch for twenty-five years.

PERCY E. WRIGHT, consulting mechanical engineer of Seattle, has been appointed assistant sales manager in a Western office of the Reeves Brothers Co., Alliance, Ohio. This company recently established an office in Seattle.

STEPHEN T. DELAMATER announces that he has resigned as chief of the amortization section of the income tax unit, Bureau of Internal Revenue and has returned to private practice as consulting engineer at 907 Fifteenth St. N.W., Washington, D. C.

MARCEL ATLAS has resigned his position as mechanical engineer with the Auto Strop Safety Razor Co. to become chief draftsmen of the tool engineering division of the Locomobile Co. of America at Bridgeport, Conn.

MARTIN P. RICE will have charge of the advertising and publication department of the General Electric Co., Schenectady, N. Y., when they are combined on Dec. 1.

FRANCIS B. BICKLEY has been appointed assistant manager of the Blair Manufacturing Co., of which A. B. CASE is general manager, at Springfield, Mass. Mr. Bickley was formerly purchasing agent for the C. C. Lewis Co., wholesale hardware dealer, of Springfield.

D. I. WHEELER, who for the past eight years has been manager of the Cleveland office of the Morse Chain Co., of Ithaca, N. Y., has accepted the position of sales engineer for the Ramsey Chain Co., Inc., of Albany, N. Y.

E. W. EDWARDS, president of the Edwards Manufacturing Co., Cincinnati, Ohio, has been elected president of the Cincinnati Industrial Investment Co., a newly-organized concern with a capitalization of $1,000,000. This company will assist in financing concerns that seek a business location in Cincinnati.

H. L. UNLAND, for thirteen years engineer with the General Electric Co., eleven years of which were spent in the Power and Mining Department, leaves that concern Dec. 1 to take the position of electrical engineer with the Victor Talking Machine Co. at Camden, N. J.

E. E. HELM has been appointed manager of the Detroit district for the Bridgeport Brass Co., Bridgeport, Conn.

GENERAL GUY E. TRIPP, chairman of the board of directors, the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been decorated by the Japanese government with the second degree order of the Sacred Treasurer. This is the highest honor that can be awarded a civilian foreigner by the Japanese government.

T. J. MCMANIS, who has been manager of the publicity department for the Edison Lamp Works of the General Electric Co., Schenectady, N. Y., will be an assistant manager of the newly created advertising and publication department.

P. G. ZIMMERMANN, chief airplane engineer of the Aeromarine Plane & Motor Co., has just returned to New York from Omaha where he witnessed a series of tests on the metal fuselage light service mail plane constructed by his company. During these tests, Mr. Zimmermann flew from Omaha to Chicago in the mail pit of the ship.

M. J. CAHILL has left the employ of the Dominion Engineering Works, Montreal, where he was superintendent of the foundry department for the past four years.

FRANK H. GALE, who for the past seventeen years has had charge of the General Electric Co advertising in periodicals, has been promoted to the staff of Dana R. Bullen, assistant vice-president. The advancement will become effective on Dec. 1.

EDMUND HERBERT JAHNZ has been appointed Philadelphia agent for the Mercury Manufacturing Co., Chicago. His headquarters will be at 2009 Market St.

ROBERT S. WHIPPLE, joint managing director of the Cambridge & Paul Instrument Co., Ltd., of Cambridge, England, is visiting Canada. Mr. Whipple is one of the leading English authorities on the construction of scientific instruments.

Obituary

ALBERT D. JOHNSON, aged 58 years, died suddenly Nov. 1 at his home in Indianapolis. He was the secretary and treasurer of the Diamond Chain & Manufacturing Co., Indianapolis, Ind. Mr. Johnson had been identified with the Diamond company since its organization in 1905. He was identified with the bicycle industry when it was at its height and was connected with both the Waverly Bicycle Co. and the Central Cycle Co. His death followed by one day that of his wife.

CHARLES WESLEY OSGOOD, for many years owner and manager of a foundry and machine shop making a specialty of paper mill machinery in Bellows Falls, Vt., died in that town Nov. 7 at the age of 82 years.

FRANK B. FERRIS, of Charlotte, N. C., vice-president of the Textile Mill Supply Co. and president of the Charlotte Manufacturing Co., both of that city, died recently at Guthrie, Okla., while on a business trip in the interests of the mill supply company, following a few days' illness. He was 67 years of age

FENWICK YOUNG, of Birmingham, Ala., former president of the Southern Supply and Machinery Dealers' Association, prominently identified with the machinery and machine tool business for years in the South as the president of the Young & Vann Supply Co., of Birmingham, died recently at his home in that city at the age of 54 years, following an illness of about three months.

Business Items

The U. T. Hungerford Brass & Copper Co., New York City, has just opened a new warehouse at 411 to 429 D St., Boston, Mass.

The Atherton Engineering Co. of Milwaukee, Wis., has changed its corporate title to Atherton Transformer Co.

The Rodney Hunt Machine Co., Orange, Mass., suffered a loss of $5,000 by a fire in a storage building recently.

Effective Nov. 12, a new price of $58 is announced on the Black & Decker half-inch special portable electric drill. Another reduction is also announced on the Black & Decker electric valve grinder. The new price is $34, the former price having been $45.

It has been announced by the International Trade Developer, Inc., that its Kobe, Japan, office has advised that there are many inquiries for machine tools listed. Manufacturers in this country are requested to cable their offers setting forth the name of their product, prices and terms.

A Southern warehouse and general sales offices will be shortly established in Atlanta, Ga., by the Koehring Machinery Co., of Milwaukee, according to an announcement made by Phil Koehring, president of the company. Edgar Alexander, of Atlanta, will be in charge of the branch as Southern manager.

The Stanley Works, New Britain, Conn., will erect a brick mill construction addition seven stories high, 60x140 ft. to the Stanley Rule & Level Co. division plant on Elm St., New Britain.

The Renz-Bullen Co., 1400 West Fort St., Detroit, organized last March, when it bought out the trimming and top department of the Puritan Machine Co., has added still more floor space and now has in excess of 20,000 sq.ft. of space.

Babcock, Wilcox, Ltd., of London, England, and the Goldie & McCulloch Co., Ltd., Galt, Ontario, and the Babcock & Wilcox Co. of New York, have organized a new Canadian company to manufacture boilers, engines, etc., under the name of Babcock-Wilcox and Goldie-McCulloch, Ltd. with head office and works at Galt. The capitalization of the new company is $3,000,000, and there will be branch offices in Vancouver, Winnipeg, Toronto, Montreal and the Eastern provinces.

French Automobiles and American Machine Tools

Industries all busy in France and machine tools needed—Exchange rates form barrier for American made tools at the present time—Solution not in sight

BY A PARIS CORRESPONDENT

THE 1923 Salon de l'Automobile which closed its doors on Oct. 14 was the most successful in the annals of motor car exhibitions in France. It is estimated that the total attendance was three times that of last year. On most of the days the crowd was so dense that visitors could move about only with the greatest difficulty, while a careful inspection of the new models of cars was, except to the most determined, out of the question.

The number of entries was so great that it was decided to hold the truck exhibition later. This plan, it is beleved, will also be preferable, since it will afford a better opportunity to visitors to examine the new models at their leisure, free from the crush that characterizes the exhibition of pleasure cars.

The principal reason for the popularity of the 1923 Salon was no doubt the increasing interest of the public in low-powered and low-priced cars. It may be said that the universal use of motor cars in France is at last coming into its own and that flivver makers are beginning to feel that they are on the verge of a buying boom that only the most optimistic thought either possible or probable a year or two ago. Some of the makers of flivvers operated so many fleets of trial cars during the period of the show, for the benefit of prospective buyers, that circulation on the broad Avenue des Champs Elysées, one and a quarter miles in length, on which the Salon is situated, was almost impossible.

It is reported that all makers of low-priced cars received substantial orders from agents and that André Citroën, the most important small car builder in France, is about to increase his production to 250 cars per day. He has recently issued lists of several hundred machine tools on which he is asking bids and on which already a considerable number of orders has been placed.

CITROËN'S PLANS

Citroën's business has far outgrown the original great shell factory on the banks of the Seine, near the Champ de Mars. In this plant only 10 hp. cars are built, the new 5 hp. model being constructed in the former Clément-Bayard factory at Levallois-Perret, taken over last year. In addition, a number of smaller plants for parts are operated in the suburbs of Paris. The success of the Citroën undertaking has given rise in France to a great deal of pride in the far-sightedness of this French automobile builder, who was undoubtedly the pioneer in France in the belief that this country could support a factory designed to build cheap cars on mass production lines and thereby to convert a traditionally conservative population to the widespread use of the motor car.

Citroën's success has encouraged many others and the coming year promises to see a very large number of new small cars on French roads. This industry is also greatly favored by the exchange rate, which at 75 to 80 francs to the pound sterling permits French makers to export their cars in increasing numbers to England, Holland, Spain, Switzerland, Scandinavia and other countries whose currency is at par. In this respect it may be claimed that the depreciated franc is of real benefit to this great French industry, while it is a serious handicap to British builders.

MACHINE TOOL DEMAND

The general and widespread improvement in the automobile industry has naturally brought about a fairly active demand for machine tools, which has to a great extent been satisfied by purchases within the country of new and second-hand machines left over from the war and imported during the boom that followed the armistice. In some cases, also, builders have rented completely equipped factories in which to make parts. The low purchasing value of the French franc that has helped the automobile builders to export has inversely prevented them from satisfying their machine tool needs by purchases from other countries, except in those rare cases where certain types of machines are needed that cannot be found in surplus stocks in France.

The amount of capital at the disposal of French builders is still insufficient to permit them to pay the heavy prices for American machine tools that obtain after the dollar has been converted into francs at the rate of 17 or 18:1. What the situation will be after the present stocks of surplus machines are exhausted is problematical.

Already there is a scarcity of numerous types of machines both in France and Belgium, and the prices of many second-hand machines have doubled during the past year. It may be that increasing prices will bring out quantities of machines that have hitherto been held back from the second-hand market or that an early settlement of the Ruhr situation will pave the way for the importation of German machines at considerably lower prices than those asked for machines coming from America. Whatever is to be the origin of the machinery, it is certain that if French industries are to continue developing new and modern machines will be required to fill the gap created by the scarcity of men with which they are now confronted.

It is common to see in the press of other countries attention called to the fact that there is no unemployment in France, and comparisons are frequently drawn with the situation in England as proof that France is more prosperous than England. In these comparisons, however, it is quite overlooked that France has never had the numbers of industrially trained men that some of the other nations possess and that her losses during the war were proportionately heavier. It is this fact more than anything else that has been responsible for the comparatively small number of unemployed and that now accounts for the fact that there are practically no unemployed whatsoever in the country.

Outside the automobile and parts industry, the general improvement is also marked and factories seem to be well filled with orders. Manufacturers of lathes, of which there are several in France, are busy and one of the largest is several months behind on his orders. Planer builders likewise have many orders, the selling prices of French-built planers being about half the cost of bringing planers from the United States. In general, however, if a few types of machines such as lathes, planers, upright drilling machines, slotters and shapers are excepted, it can be said that very little progress in machine tool building has been made in France.

In upright drilling machines, the well known woodworking machinery firm of Gilliet et Fils in Auxerre is building a very complete and well-designed line and as its prices for both cone and all-geared machines are considerably cheaper than those of similar American machines it is likely that the French machines will grow in popularity.

In shapers, the French built machines are greatly inferior in design, power and workmanship to American machines, but as they are sold for approximately one-third to one-half the prices asked for new American shapers they are purchased when good second-hand American shapers are unobtainable. When it is considered that an American shaper that lists for $1,000 costs landed in France about 20,000 francs, while the same machine before the war cost less than 4,000 francs it will be seen how great are the present obstacles to the Franco-American machinery trade. It is, of course, out of the question for the average buyer to pay 20,000 francs for an American shaper, even though it may be greatly superior to the French or European machine. And it will continue to be out of the question either until the exchange rate materially improves or until some marked change takes place in the industrial situation that will oblige or permit factories to invest such large sums in equipment.

EXPANSION OF AMERICAN COMPANIES

American companies that operate branch factories in France are apparently prosperous, since most of them have greatly increased their manufacturing capacity during the past year, several having even built new works to cope with the increased demand for their product. Their wisdom in establishing manufacturing facilities in France has been amply demonstrated during the last few years and should be an encouragement to others who are at present excluded from the French, Belgian and Italian markets by the high rate of exchange.

Great Britain and the Bicycle Business

Important source of trade for the machine tool business steadily improves—Motorcycles also in good demand—General conditions badly slumped, but prospects better

BY OUR LONDON CORRESPONDENT

IT MAY be well to begin by indicating a brighter outlook, even if the view changes suddenly to one of a different character, and the recent cycle show held at Olympia, London, W., has drawn public attention to a branch of the British engineering industry which may fairly be claimed to be holding its own, and perhaps a little more when present conditions are kept in mind. The exports of ordinary cycles and parts from this country during the first eight months of this year have been valued at more than 1¾ million pounds, while the corresponding imports were worth less than a quarter of a million pounds. Great Britain in this direction has done better of late i Australia, South Africa and India. Japan too, is one of the best customers, and, it has been stated, has six million bicycles. The view is not very different as regards motorcycles, for exports, in worth, have exceeded three-quarters of a million pounds, while the motorcycle imports amounted to but £54,000.

One of the leading British cycle firms will build for next season 100,000 ordinary cycles plus 10,000 motor cycles, and sold last year 71,000 cycles. The ordinary bicycle industry dates back now 50 years, to the early productions in Coventry. The motorcycle trade is of course of more recent growth, and in its earliest years depended pretty thoroughly on imported engines, the British engine dating, it has been stated, from 1903. Now, apart from accessories, we have about 100 firms engaged in the manufacture of these engines and motorcycles.

Taking a larger view, the outlook is less pleasant, and the numbers of unemployed recently registered have steadily increased and have passed the 1¼ million mark. In addition, it is necessary to repeat, are many persons only partly employed, and a considerable number who, being temporarily or permanently outside the unemployment insurance benefits, are not recorded in the figures given. Then too, the cost of living has again increased, and in this direction almost all the gain that had been made as compared with a year ago has been lost. It is beyond question that the costs and profits of distribution bulk largely in the increased figures, and traders and others are being plainly told that one way to improve the present position would be to lower their prices. The rising cost of living figures will imply increased wages in certain industries; indeed for three months now the increases reported have more than equalled the decreases. But taking 1923 as a whole, so far, a net reduction is still shown.

The machine tool industry may be rather better off than it was, but in any case the difference is trifling. Certainly some firms have been able to reduce their stock and are proceeding to manufacture up to the limit they consider desirable. Some of the firms have thought that in the stress of circumstances the policy of specialization generally adopted would be broken down, and this is true in certain instances. On the other hand, complaint has been made that firms will not build machines outside their usual lines, and that it has been necessary to import from America for this reason.

The small tool side has several times been regarded as at least comparatively busy, but a visit to some of the shops would not confirm any such impression at the moment. As for some time past, it is the railway shops that have been looked to for orders for machine tools, and in preparation for next year some of the motor car firms have also been attempting to put their houses in order. The German machine tool has been described as the bugbear of the British machine tool man. It is undeniable that for some time machines have been slowly moving into the country, mainly to be put into stores to await the better times that must come. A few relatively large tools have lately been definitely put into commission, and apparently two or three firms on the Northeast coast of England and in the Glasgow area of Scotland have provided customers for Germany in this direction.

> "As for some time past the railways have been looked to for orders for machine tools, and in preparation for next year some of the motor car firms have also been attempting to put their houses in order. The German machine tools have been the bugbears of the British machine tool dealer. It is undeniable that for some time past machines have been slowly moving into the country from Germany to be held in storage until better times."

Some machine tool men have argued the need for their services in a number of our shipyards, but the fact that the times are not propitious is made evident in the latest report on shipbuilding, which indicates that the gross tonnage under construction in Great Britain and Ireland is rather more than 1¼ million, or, taking into consideration the fact that on nearly ¼ million tons work has been suspended, rather more than a million tons is actually under construction. This is the lowest figure for about 14 years. It happens to coincide almost exactly with the total tonnage under construction in all countries abroad, as far as is known. Here Germany and Danzig together account for about one-third million tons, Italy and France each about one-seventh million tons, and Holland and the United States each about one-tenth million tons. The position will be understood more readily by the statement that in the United Kingdom during the 12 months preceding the war 1,890,000 tons was the average under construction.

Meanwhile, spurred on by circumstances, the government is announcing and supporting a number of schemes of work to be put in hand at once, the expenditure on which will probably amount to at least 50 million pounds. The railway companies have also been almost forced to publish their programs, and, apart from maintenance work and renewals, are to spend considerable sums on locomotives, rolling stock, etc. The tube railways of London, which have already had a guarantee of 6 million pounds, will have that sum doubled, and a power scheme in North Wales has been guaranteed up to more than 1½ million pounds.

Another Canadian Ford Plant

The Ford Motor Co. is looking for a convenient site in the Province of Quebec, Canada, to build a manufacturing plant, it is understood. Up to the present time, four cities have been visited by an official of the company, and offers of sites have been made by Three Rivers, Sherbrooke, Montmagny and Levis.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Concrete mixers, stone crushers, and concrete chuting plants. Barcelona, Spain. Purchase. Reference No. 8113.

Machine tools. Calcutta, India. Agency. Reference No. 8107.

Forthcoming Meetings

National Founders' Association. Twenty-seventh annual convention. Hotel Astor, New York City, Nov. 21 and 22. J. M. Taylor, secretary, 29 S. LaSalle St., Chicago.

American Society of Mechanical Engineers. Annual meeting, Dec. 3 to 6, in New York City. Calvin W. Rice, 29 W. 39th St., New York City, secretary.

National Exposition of Power and Mechanical Engineering. Second annual exposition to be held at the Grand Central Palace, New York City, Dec. 3 to 8. Headquarters, Grand Central Palace, New York City.

Society of Automotive Engineers. Annual meeting, Jan. 22 to 25, at the General Motors Building, Detroit, Mich. Coker F. Clarkson, 29 W. 39th St., secretary.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

New and Enlarged Shops

Machine Tools Wanted

Ind., Indianapolis—W. J. Holliday & Co., 326-90 West Georgia St., J. S. Holliday, Pres. — complete equipment, including punches, brakers, saws, plate shears, etc., for proposed steel fabricating plant.

Kan., Baxter Springs—Baxter Machine Co.—20 in. swing, belt driven lathe.

Kan., Baxter Springs—Gilam Garage—drill press (used).

Kan., Baxter Springs—J. Higgenbothan, Military Ave.—drill press for blacksmith shop.

Md., Baltimore—Baltimore Tube Co., 1301 Wicomico St.—roll grinder to grind chilled rolls for 12 to 24 in. diameter.

Mich., Detroit—J. E. Barrett Co., 6545 Epworth Blvd. (machine shop)—one structural type punch press and one bolt threader.

Mo., Carl Junction—Magoon Auto Co.—drill press.

Mo., St. Louis—T. H. Glancy, Marquette Hotel—general equipment for garage on 18th and Charles Sts.

Mo., St. Louis—H. L. Kuhlmann, 5149 Easton Ave.—lathes, etc., for garage.

N. Y., Le Roy—F. W. Syler, Main St.—equipment, tools, press and vise for garage repair shop.

N. Y., Utica—J. S. Pickell, Lincoln Ave.—press, tools and equipment for new garage.

N. Y., Watertown — Weldon & Gillock, Factory St.—garage repair tools and equipment.

N. Y., Watervliet—J. F. Ballard, 1-11 19th St.—small lathe, press and tools for garage.

O., Columbus—L. E. Lowe & Sons, 705 Southwood Ave. (manufacturer of air compressors, also general machine shop), L. E. Lowe, Purch. Agt.—machine tools, including grinder and drill press, to enlarge shop.

O., North Baltimore—France Fdry. & Machine Co., H. M. France, Mgr.—equipment, including grinder, 24 in. lathe, etc., to enlarge capacity of plant.

O., Painesville—Main St. Automotive Co., C. C. Hawkins, Purch. Agt.—repair tools, press and equipment for new garage.

Okla., Hockerville—Craig & Borthick—lathe and drill press for garage and machine shop.

Okla., Hockerville—J. M. Johnson—lathe, hand tools, anvil, vise, forge and drill press for blacksmith shop.

Pa., Northampton—Lilly & Lentz—tools, press and equipment for proposed automobile repair shop.

Pa., Pennsburg — Jackson Motor Co. — emery wheel, presses, tools and equipment for new garage.

Pa., Pittsburgh—Natl. Tube Co., Frick Bldg., S. M. Lynch, Purch. Agt.—shaper, lathe and drill press for Riverside Wks. at Benwood, W. Va.

Pa., Pittston—Falcone Bros., Jenkins Alley—tools, small lathe and equipment for new garage repair shop.

Pa., Sugargrove—Malian & Stoddard, R. Stoddard, Purch. Agt.—small lathe, press and repair tools for garage.

Tex., Kaufman—Kaufman Machine Shop—lathe, 24 in. swing, 12 ft. bed; lathe 14 ft. bed.

Va., Ashland—W. F. Fuque—drill press and lathe for automobile repair shop.

Va., Ashland — V. Priddy, Washington Highway and England St.—lathe for automobile repair shop.

Wis., Hurley—Norman Auto Co., B. E. Norman, Pres. — automobile repair machinery, gasoline tanks, pumps, etc., for proposed $40,000 garage.

Wis., Milwaukee—Sunbeam Mfg. Co., 166 Martin St. (manufacturer of automobile accessories), W. M. Baumhackel, Purch. Agt.—20 in. drill press, tool room lathe, emery wheel, stand, etc.

Ont., Avonmore—W. A. Aubury—lathe for automobile repair shop.

Ont., Cornwall—Fursey's Sales & Garage Co., Pitt St., R. J. Fursey, Purch. Agt.—drill press, vise, tools, etc., for garage.

Ont., Lancaster — H. MacLeod — garage tools and equipment.

Ont., Ottawa—F. H. Plant, Ltd., 111 Murray St. (carriages, etc.)—blacksmith and machine shop equipment.

Ont., Renfrew—W. Dean—complete garage equipment, to replace fire loss.

Que., Lachine—O. Ouenneville, 370 St. Joseph St.—garage equipment, bench tools, etc.

Que., Longueuil—J. F. K. Leduc, 168 St. Charles St.—automobile repair machinery, tank and pump for garage.

Que., Montreal—D. Lalonde, 634 Parc Lafontaine—small drill press, air compressor, etc.

Que., Montreal—T. Lalonde & Fils, 3034 Notre Dame St., E.—equipment and tools for garage.

Que., Westmount—P. H. Reid & Co., 118 Strathern Ave.—complete equipment for garage and automobile repair shop at 92 Inspector St., Montreal.

Machinery Wanted

Calif., Los Angeles—J. Ward, 108 East 98th St.—12 x 18 in. job press, also cylinder press.

Conn., Waterbury—Bd. Educ.—$5,000 worth of small machinery for manual training department at Malony School.

Ill., Chicago—Illinois Central R. R., 135 East 11th Pl., J. J. Bennett, Purch. Agt.—1½ to 6 in. motor driven tube cutting machine.

Ill., Chicago—Junkunc Bros., 1145 West Garfield Blvd.—18 gage salvage steel cold rolled or pickled to stamp out blanks 1⅞ x 17¾ in., car load or less; cold rolled bar steel, 1½ x ¾ in.

Ill., Chicago—Wanner Mchy. Co., 716 South Dearborn St.—10 x 15 in. Chandler & Price press and a 25 in. lever paper cutter.

Ill., Riverdale—G. L. Kochler—25 x 38 in. Miehle printing press.

Ill., Rockford—Free Sewing Machine Co., 18th Ave. and 11th St., A. E. Johnson, Purch. Agt.—electric furnace, traveling crane and moulding machine.

Ind., Fort Wayne—The city, A. W. Grosnevor, 122 East Washington St., Engr.—receiving bids about Dec. 10 for a 100 ton hoist for a movable dam on the Maumee River.

Ind., Mount Vernon—The Print Shop, B. O. Hanly, proprietor—10 x 15 in. and 12 x 18 in. job press with throw off.

Ia., Cedar Rapids—Iowa Ry. & Light Co., 201-203 2nd Ave.—one electric traveling crane, about 5 ton.

Kan., Baxter Springs—F. M. Congdon & Son—bandsaw for planing mill.

Kan., Baxter Springs—Herald, Box 287—paper cutter, Miller feeder and job printing press.

Kan., Baxter Springs—Hub Shoe Shop, 1022 Military Ave.—stitcher and dustless finisher (used).

Kan., Pittsburgh—Hull & Dillon Packing Co.—raw water ice plant.

Mich., Detroit—Wolverine Stone Co., 7976 Riopelle St.—one Bradley or Beaudy power trip hammer for blacksmith shop.

Mo., Bernie—G. W. Ray—cylinder, 6 column, quarto newspaper press and a 10 x 15 in. job press.

Mo., Clinton—Daily Clintonian—Miller saw with router.

Mo., St. Louis—Burke Coal Co., 1626 Chemical Bldg., J. T. Burke, Purch. Agt.—electrically driven coal conveyor, tipple machinery, etc., for mine, 500 ton daily capacity, near Shelbyville, Ill.

Mo., St. Louis—H. Habben, 312 North Locust St.—automatic card printing job press.

N. Y., Amsterdam—Carana Mfg. Co., H. Hanna, Purch. Agt.—machinery and equipment for new plant for the manufacture of automobile accessories.

N. Y., Ballston Spa—Saratoga County Paper Co., Inc. (manufacturer of box board), F. A. Talbot, Jr., Treas.—four beaters, and one pipe threader, similar to Oster 6 in. size, to be purchased in the spring of 1924.

N. Y., Bath—L. S. Everson, McMaster St.—complete sawmill machinery and equipment.

N. Y., Binghamton — J. A. Polakas, 1 Miles St. (publisher)—presses and equipment for immediate expansion program.

N. Y., Breesport — Breesport Mineral Spring Bottling Wks., E. Furgeson, Purch. Agt.—machinery and equipment for the manufacture of soft drinks.

N. Y., Brooklyn—D. MacMillan & Son, 1371 Atlantic Ave. (pneumatic carriers)—one splitting machine for leather.

N. Y., Buffalo—Erie County, 76 Exchange St.—equipment for workshop of asphalt plant at Hamburg.

N. Y., Buffalo—F. A. Flierl, 854 Kensington St.—planing mill machinery and equipment (new).

N. Y., Dunkirk—Dougherty Bros., F. L. Dougherty, Purch. Agt.—complete gas well drilling outfit.

N. Y., Dunkirk—Thomas Furniture Wks., E. C. Thomas, 312 Leopard St., Purch. Agt.—woodworking machinery and equipment for proposed plant.

N. Y., Hamilton—Madison County Basket Corp., C. F. Robb, Jr., Webster, Purch. Agt.—machinery and equipment for proposed plant for the manufacture of baskets.

N. Y., Kingston—Pepco Stations, Inc., D. R. Peffer, Purch. Agt.—several gasoline pumps and tanks for proposed service stations.

N. Y., Lockport—Vera Chemical Co. (manufacturer of gloss oil)—machinery and equipment for proposed plant, including two 10,000 gal. storage tanks for naphtha.

N. Y., Morris—Tioga Wood Products Co.—chemical machinery and equipment for new plant.

N. Y., Niagara Falls—Carborundum Co., Buffalo Ave. and 18th St.—machinery and equipment for proposed $60,000 factory for the manufacture of carborundum products.

N. Y., Oakfield—United States Gypsum Co.—special machinery and equipment for new plant for the manufacture of wall board and sheet rock.

N. Y., Palmyra—Alert Products Co., Inc.—chemical machinery and equipment for the manufacture of automobile pumps and accessories, to replace that which was destroyed by fire.

N. Y., Penn Yan—Tempter Corn & Fruit Products Co.—canning machinery, equipment, shafting, hangers, etc., for corn and pea canning plant.

N. Y., Potsdam—Wood Bros., Depot St., F. Wood, Purch. Agt.—complete machinery and equipment for proposed laundry.

N. Y., Rochester—Carrib Mfg. Co., 46 Stone St. (manufacturer of carbon paper and ribbons), W. C. Runne, Purch. Agt.—machinery, equipment, shafting, hangers, etc., for new plant.

N. Y., Rochester—Verwey Printing Co., 15 Euclid St.—presses and equipment for proposed $50,000 printery.

N. Y., Saratoga Springs—Baker Mfg. Co. (foundry), J. J. Case, Purch. Agt.—ten sets of ball bearing applications and forty cylinder moulds for paper machine.

N. Y., Syracuse—Associated Laundries, Inc., 405 Hickory St., C. H. Parmelee, Pres.—laundry machinery and equipment, to replace fire loss.

N. Y., Utica—Scala Packing Co., 713 Bleeker St. (meat packers)—refrigeration equipment and special machinery for proposed plant.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Belief prevalent among consumers that pig-iron prices have about reached bottom. Buying now fairly active. Steel prices stiffening at Pittsburgh mills, particularly in light rails. Iron and steel scrap higher. Pittsburgh mills active with increased employment. Volume of steel buying by railroads and automotive industries, however, not up to expectations.

Advances—Aluminum ingots up 1c. per lb.; increase reported due to tariff influences. Lead advanced 5c. per 100 lb. in week. Solder also higher in New York. Non-ferrous metals advanced in Cleveland warehouses.

Declines—Minimum on galvanized steel sheets down 10c. per 100 lb. at Pittsburgh. Tin declined ¾c. per lb. in week. Antimony ¼c. per lb. lower in New York on European shipments; no quotations on Asiatic metal.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	....
New York	5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00	4.59	3.75	4.00
No. 12	3.10	4.64	3.80	4.05
No. 14	3.20	4.69	3.85	4.10
No. 16	3.40	4.79	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.95	4.45	4.70
Nos. 22 and 24	3.75	5.00	4.50	4.70
Nos. 25 and 26	3.80	5.05	4.55	4.75
No. 28	3.85	5.15	4.65	4.85
Galvanized				
Nos. 10 and 11	3.90@4.00	5.15	4.70	4.85
Nos. 12 and 14	4.00@4.10	5.25	4.80	4.95
Nos. 17 and 21	4.30@4.40	5.55	5.10	5.24
Nos. 22 and 24	4.45@4.55	5.70	5.25	5.40
No. 26	4.60@4.70	5.85	5.50	5.55
No. 28	4.90@5.00	6.15	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded.	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	⅞	$0.16	35%
¼ to ½	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.55
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.65	3.90	4.55
Cold drawn flats, squares	5.15	4.40	5.05
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 5/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound			
Copper, electrolytic (up to carlots), New York			14.00
Tin, 5-ton lots, New York			43.62½
Lead (up to carlots), St. Louis	6.70	New York	7.22½
Zinc (up to carlots), St. Louis	6.40	New York	6.85

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	27.00	26.50
Antimony (Chinese), ton spot	10.12½	10.50	10.50
Copper sheets, base	20.25	21.00@21.25	23.00
Copper wire, base	15.00	19.00	16.25
Copper bars, base	19.25	22.50	19.50
Copper tubing, base	23.00	27.25	23.00
Brass sheets, base	17.00	22.00	18.75
Brass tubing, base	21.50	27.00	20.50
Brass rods, base	14.75	18.00	15.75
Brass wire, base	17.50	22.00	....
Zinc sheets (casks)	10.25	10.45	....
Solder (½ and ½), (case lots)	31.00	30.00	28.50
Babbitt metal (83% tin)	52.00	54.00	45@48
Babbitt metal (35% tin)	25.00	17.50	20@25
Nickel (ingot and shot)	29.00	....	....
Nickel (electrolytic)	32.00	....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.75	11.25	11.25
Copper, heavy, and wire	10.75	10.75	10.50
Copper, light, and bottoms	9.50	8.75	9.50
Lead, heavy	5.75	5.25	5.75
Lead, tea	4.75	4.00	4.75
Brass, heavy, yellow	7.00		7.00
Brass, heavy, red	8.75	9.25	8.75
Brass, light	6.25	5.00	6.00
No. 1 yellow brass turnings	7.00	5.75	6.50
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.14
Cotton waste, colored, per lb.	.08@.13	.12	.10½
Wiping cloths, 13¼x13¼, per lb	11.00	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.		52.00 per M	.16
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.98	1.05	1.14
Lard cutting oil (50 gal. bbl.) per gal	.55	.50	.67½
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.297	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5–2½	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.50@4.00
Coke, prompt foundry, Connellsville	per net ton		5.00@5.50
White lead, dry or in oil	100 lb. kegs		New York, 14.00
Red lead, dry	100 lb. kegs		New York, 14.00
Red lead, in oil	100 lb. kegs		New York, 15.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.0465	0.0465	0.039
Brass rods	per lb	0.1475	0.1525	0.17
Solder (½ and ½)	per lb.	0.31	0.295	0.275
Cotton waste	per lb.	.10@.13	.10@.13	.09@.11½
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.60
Machine oil	per gal.	0.31	0.297	0.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts up to 1x30 in.	off list	40–10%	40–10%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40–10%	60%	45–5%
1½ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	25–10%	$3.50 net	
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30–10%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	
Hex. head and hex. nut bolts	List net		65–5%
Lag screws, coach screws	40–10%		60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	30–10%	50%	40–5%
Bolt ends, with hot pressed nuts	40–10%		55%
Tap bolts, hex. head, list plus	35%		
Semi-finished nuts, 9/16 and smaller	60%		
Semi-finished nuts, ⅝ and larger	55%	70%	80%
Case-hardened nuts	40%		
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	0.50	3.50	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	0.50	3.50	2.50
Nuts, cold punched, sq., per 100 lb. Off list	0.50	3.50	2.50
Nuts, cold punched, hex., per 100 lb. Off list	0.50	3.50	2.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50–10%	60%	60%
Rivets, tinned	50–10%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.60	$3.75
Cone heads, ditto (net)	5.60	3.80	3.85
1⅛ to 1¾-in. long, all diameters, *EXTRA* per 100 lb.	0.25		0.15
⅝ in. diameter *EXTRA*	0.15		0.15
½ in. diameter *EXTRA*	0.50		0.50
1 in. long, and shorter *EXTRA*	0.50		0.50
Longer than 5 in. *EXTRA*	0.25		0.25
Less than 200 lb. *EXTRA*	0.50		0.50
Countersunk heads *EXTRA*	0.35		$3.70 base

N. Y., Walker—Walker Evaporator Co.—complete machinery and equipment for apple evaporator, to replace fire loss.

N. C., Wilmington—Carter's Production Wks., 210 South Front St., O. Carter, Mgr.—buffer fitted up with long spindles through a 2 hp. 60 cycle single phase, 110 volt enclosed motor.

O., Ada—M. A. Conner—complete paint shop equipment and automobile repair tools.

O., Cincinnati—C. Todd, 615 Elm St.—job printing press, belting, hangers and paper cutter.

O., Columbus—Miller-Lerch Shoe Mfg. Co., 31 North 4th St., E. E. Lerch, Purch. Agt.—equipment for shoe factory.

O., Lima—R. L. Graham Co., 223 East Market St., F. Townsend, Purch. Agt.—machinery for the manufacture of ice cream (new).

O., Willard — Willard Times — saw trimmer.

O., Youngstown—Bertolini Bros., 26 North Walnut St.—equipment and stone cutting machinery for proposed tile, slate and marble plant.

Okla., Beggs—R. C. Wright—job printing press.

Pa., Bellwood—Weaver Bros—machinery and equipment for bakery, to replace fire loss.

Pa., Chester—Congoleum Co.—machinery for proposed expansion program.

Pa., New Castle—Pennsylvania Eng. Wks.—multiple punch about 120 in between housings, depth of throat 12 in.

Pa., Phila.—W. M. Steppacher & Bros., Inc., 146 North 13th St. (manufacturer of shirts)—laundry machinery, belting, hangers, shafting and pulleys.

Pa., Phila.—I. Q. Wenner, 424 West Berks St.—Universal woodworker, sander, belting and hangers.

Pa., Phila.—Woodworker Shop, 1828 East Wishart St. (cabinet shop)—belting upright molder, cutters and bandsaw.

Pa., Phila.—E. Wrigley, 821 Callowhill St.—8 x 12 in. job press, also a 10 x 15 in. printing press.

Pa., Pittsburgh — Guibert Steel Co., Diamond Bank Bldg.—one 5 ton, 50 ft. 6 in. span, 3 motor crane.

Pa., Pittsburgh—Standard Sanitary Mfg. Co., Bessemer Bldg. (manufacturer of plumbing fixtures)—seven cranes for new Baltimore plant.

Pa., Scranton—Riccardi Macaroni Co., 716 West Lackawanna Ave.—complete machinery for the manufacture of macaroni.

Tex., Karnack—Taylor Mill & Elevator Co., T. J. Taylor, owner—machinery for grain elevator at Marshall.

Tex., Texas City — Pierce Oil Corp. — equipment for refinery.

Vt., East Dorset—Manchester Marble Co.—small tools and machinery for roughing, polishing and finishing marble, to replace fire loss.

Va., Ashland — C. S. Boschen, Railroad Ave.—5 ton ice making machine.

Va., Ashland — Burgess Bros. (job printers)—paper cutter.

Va., Ashland—S. R. Carter, et al., England St.—equipment for creamery.

W. Va., Charleston—Gibraltor Coal Co., 110 Hale St.—conveyors, mining machinery and equipment for proposed coal operations in the Kanawha field.

W. Va., Charleston—Job Print Shop, Box 1395—40x55 in. or larger Optimus or Miehle press.

W. Va., Weirton—Weirton Steel Co.—one 10 ton crane for Steubenville, O.

W. Va., Wheeling—Dillon Bros. Machine Co.—one 5 ton, 27 ft. span, 3 motor crane.

W. Va., Wheeling—Scott Lumber Co.—complete planing mill machinery and equipment, to replace that which was recently destroyed by fire.

Wis., Ashland—J. M. Chapple & Co., 321 West 3rd St.—presses, linotype machine, etc., for proposed $50,000 printing plant.

Wis., Atwood (Owen P. O.)—Farmers Co-operative Co.—produce loading and unloading machinery.

Wis., Bowler—Bowler Lumber Co., W. O. Baum, Purch. Agt.—large re-saw, planer and bandsaw.

Wis., Eau Claire—Newman Electric & Mfg. Co., 428 Water St.—equipment for the manufacture and repair of electrical specialties and appliances.

Wis., Milwaukee — Fillmann Bros., 334 Bway., W. Fillmann, Purch. Agt.—one 20 to 30 in. paper cutter and one platen press.

Wis., Milwaukee—R. Kiel, Concordia and 31st Sts. (machine shop)—one 5 to 10 ton traveling crane.

Wis., Oshkosh—M. C. Flanagan, 68 Evans St. (newspaper and job printer)—rotary press, belting, hangers, pulleys, linotype machine and bearings.

Wis., Owen — Master Package Corp. (manufacturer of fibre containers), H. M. Wollum, Purch. Agt.—paper cutter and corner turning machine.

Wis., Waukesha—Manitowoc Church Furniture Co., 1214 Lincoln Ave.—woodworking machinery, motor driven, for proposed $50,000 addition to factory.

Wis., Wausau—Underwood Veneer Co.—8 ft. single bandsaw, planers, lathe and woodworking machinery for sawmill.

N. B., Shippigan—Shippigan Packing Co., Ltd., J. J. Robichaud, Lameque, Purch. Agt.—equipment for curing and treating fish, also for the manufacture of fertilizers.

Ont., Alexandria—F. Leslie Co., F. A. Leslie, 718 Somerset St., W., Ottawa, Purch. Agt.—machinery and equipment for the manuracture of tinware.

Ont., Arnprior—F. G. Atack, c/o A. Burwash—complete equipment for the manufacture of dye and other pharmaceutic preparations for plant at Kingston.

Ont., Maxville—A. J. Filon—small tools, chain hoist, etc., for garage.

Ont., Smooth Rock Falls—Mattafma Pulp & Paper Co., Ltd.—equipment for the manufacture of unbleached sulphite pulp.

Que., Longueuil—E. Heroux, 71 4th Ave.—tool room equipment and air compressor for garage.

Que., Montreal — Belanger Fdry., Ltd., 1165 Carriere St., J. Lamarre, Mgr.—furnaces, melting pots, etc.

Que., Montreal—Bertrand Wooden Box Co., 34 Benoit St.—dove tailing machine.

Que., Montreal—Bourgie & Fils, 494 Nicolet St.—planing mill machinery.

Que., Montreal—Bruce & Price, 159 Prince St.—foundry equipment.

Que., Montreal—R. de Montigny, 1396 St. Dominique St.—equipment for the manufacture of cement blocks, etc.

Que., Montreal—J. Desautels & Co., 2821 Papineau Ave.—machinery and equipment for the manufacture of shoes, to replace fire loss.

Que., Montreal—Gunn, Langlois & Co., Ltd., 105 St. Paul St., E., H. R. Gray, Purch. Agt.—bond and shell crushers.

Que., Montreal—H. Hotte, 1401 St. Urbain St.—chain hoist, pump, etc., for garage.

Que., Montreal—Pacific Dairies, Ltd., c/o E. Leboeuf, 80 St. Clement St.—equipment for smoking and curing hams, etc.

Que., Montreal—Wood's Garage Co., 23 Ccurrol St., A. Wood, Purch. Agt.—bench tools, planer, etc.

Que., Quebec—P. Moisan, 926 Valier St.—equipment for blacksmith shop.

Que., St. Laurent—St. Laurent Quarry, C. Lapailleur, Mgr.—stone cutting machinery and equipment.

Metal Working Shops

Ala., Birmingham—The Southern Ry., 13th St. and Pennsylvania Ave., Wash., D. C., plans to build car repair works at Findley Yards, here. This will replace the one at Gadsden, which was destroyed by fire. Estimated cost $1,000,000. T. H. Gatlin, Ch. Engr. Constr.

Ark., Little Rock—The N. O. Nelson Co., 502 East 2nd St., plumbing supplies, will soon award the contract for the construction of a machine shop, warehouse, office building, etc. Estimated cost $80,000. Sanders & Ginnochio, Hall Bldg., Little Rock, Archts.

Calif., Fresno—E. Bradley, c/o Trewhitt-Shields Co., Contrs., Rowell Bldg., awarded the contract for the construction of a 1 story garage on Stanislaus and L Sts. Estimated cost $100,000, including equipment.

Calif., Los Angeles—Monaco & Bordeaux, Archts., Bank of Italy International Bldg., are receiving bids for the construction of a 1 story, 100 x 150 ft. garage on Hoover and 11th Sts. for J. Green, 1758 North Spring Street.

Conn., Bristol—The New Departure Mfg. Co. has had plans prepared and will soon receive bids for the construction of an addition to forge shop. Lockwood, Greene & Co., 24 Federal St., Boston, Engrs.

Conn., Hartford—S. Kaplan, 105 Windsor Ave., awarded the contract for the construction of a 1 story, 60 x 100 ft. garage. Estimated cost $40,000. Noted Apr. 26.

Conn., Putnam—The Putnam Fdry. & Machine Co., Mechanics St., is having plans prepared for the construction of a 1 story, 100 x 160 ft. foundry. Estimated cost $40,000. Private plans.

Conn., Waterbury—The Waterbury Farrell Fdry. & Machine Co., 425 Bank St., is having plans prepared for the construction of a 2 story, 48 x 52 ft. factory. Estimated cost $40,000. Wescott & Moses, 207 Orange St., New Haven, Archts.

Ill., Chicago—The Nugent Electric Steel Casting Co., 3100 South Wood St., is having plans prepared for the construction of a 2 story (ultimately 3 story), 40 x 120 ft. pattern and storage building. Estimated cost $70,000. F. D. Chase, Inc., 645 North Michigan Ave., Archt.

Ind., Connersville—The Connersville Automobile Dealers Assn. plans to build an automobile repair shop. Estimated cost $65,000.

Ind., Indianapolis—W. J. Holliday & Co., 326-90 West Georgia St., is having plans prepared for the construction of a steel fabricating plant, 300 x 400 ft. warehouse and 3 story office building at 600 West McCarty St. J. S. Holliday, Pres. J. C. Troyer, c/o owner, Engr.

Md., Baltimore—H. Gamse & Bros., 421 Exchange Pl., will soon award the contract for the construction of a 2 story, 25 x 104 ft. garage, etc., at 423 Exchange Pl. Estimated cost $40,000. E. H. C. Browne, Equitable Bldg., Baltimore, Archt.

Mo., Moberly—The Wabash R.R., Ry. Exch. Bldg., St. Louis, is having plans prepared for the construction of additions to shop, etc., here. A. O. Cunningham, Ch. Engr.

N. J., Jersey City—The Continental Can Co., 61 Bway, New York awarded the contract for the construction of an addition to its factory on 16th St., here. Estimated cost $500,000. Noted Sept. 6.

N. Y., Brooklyn—The Cordial Realty Co., c/o E. M. Adelsohn, Engr., 1778 Pitkin Ave., will build a garage on Pitkin Ave. Estimated cost $60,000.

N. Y., New York—The Reo Motor Car Co., 1709 Bway., will soon receive bids for the construction of a 4 story, 100 x 175 ft. service station on West 55th St. Estimated cost $200,000. Parker & Shaffer, 280 Madison Ave., Engrs. and Archts.

O., Lorain—The Amer. Stove Co., 4301 Perkins Ave., Cleveland, awarded the contract for the construction of a 1 story, 65 x 195 ft. factory and shop building, an 82 x 110 ft. japanning building and a 50 x 82 ft. warehouse, here. Estimated cost $150,000. Noted Nov. 8.

Pa., Erie—The Erie Steam Shovel Co., is having preliminary plans prepared for the construction of a 1 story addition to its factory. Cost will exceed $40,000. Osborn Eng. Co., 7016 Euclid Ave., Cleveland, Engrs. and Archts.

Pa., Erie — H. P. Westcott, Pittsburgh Ave., awarded the contract for the construction of a 1 story, 62 x 100 ft. machine shop. Estimated cost $35,000.

Pa., Phila. — The Fleischmann Co., 701 Washington St., New York, awarded the contract for the construction of a garage and office building on 20th and Venango Sts., here. Estimated cost $117,500. Noted Sept. 6.

Pa., Pittston—The Motorin Garage, Tompkins St., c/o W. J. Gillespie, is having plans prepared for the construction of a garage on Dock St. Private plans.

Pa., Sharpsburg (Pittsburgh P. O.)—The Pennsylvania R.R., Union Sta., Pittsburgh, awarded the contract for the construction of a 1 story, 6 stall roundhouse and machine shop, here.

Tex., Denison — The Missouri-Kansas-Texas R.R. of Texas, Missouri-Kansas-Texas Bldg., Dallas, awarded the contract for the construction of car shops, here. Estimated cost $200,000.

Utah, Salt Lake City—The Ford Motor Co., Higaland Park (Detroit P. O.), Mich., awarded the contract for the construction of a 2 story, 165 x 247 ft. assembly plant on 3rd South St., here. Estimated cost $250,000. Noted Sept. 20.

Wis., Madison—The Fox Motor Car Co., c/o C. N. Fox, 107 East Doty St., plans to build a 2 story, 60 x 95 ft. garage and repair shop on University St. Estimated cost $40,000. Engineer or architect not selected.

Wis., Milwaukee—The Curtis Auto Co., 142 8th St., will soon award the contract for the construction of a 3 story, 100 x 127 ft. garage on Bway. Estimated cost $200,000. Federal Eng. Co., 440 Milwaukee St., Milwaukee, Engrs. and Archts. Noted July 26.

Wis., Racine—The Belle City Malleable Iron Co., Kewaunee St., awarded the contract for the construction of a 1 story, 77 x 100 ft. addition to annealing building. Estimated cost $45,000. C. S. Anderson, Mgr.

Ont., Port Colborne—The Marine Welding & Boiler Co. plans to build additions to its plant. Estimated cost $25,000. J. Sherk, Mgr.